1-1744 K-3 6/99

SITE SAFETY PLAN ADDENDUM

AMERICAN CHEMICAL SERVICE SUPERFUND SITE
GRIFFITH, INDIANA

Montgomery Watson File No. 1252042

Prepared For:
ACS RD/RA Executive Committee

Prepared By:
Montgomery Watson
2100 Corporate Drive
Addison, Illinois 60101

JUNE 1999

MONTGOMERY WATSON

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

Montgomery Watson has developed this Site Safety Plan (SSP) Addendum to address health and safety procedures for additional remedial activities to be conducted at the American Chemical Service (ACS) Superfund Site (Site) in Griffith, Indiana. The SSP Addendum establishes health and safety procedures for field activities that will minimize potential risk to Montgomery Watson personnel performing on-site work. This SSP Addendum should be used in conjunction with the Predesign Site Investigation SSP (Predesign SSP) dated January 1996.

The Predesign SSP and the SSP Addendum apply to all Montgomery Watson employees who will potentially be exposed to safety and/or health hazards associated with the proposed field activities. Subcontractors are required to provide their own SSP which, at a minimum, must comply with the requirements of the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operation and Emergency Response Standards (29 CFR 1910.120) and other applicable OSHA regulations. This SSP Addendum has been developed based on limited knowledge regarding the specific chemical hazards and anticipated potential physical hazards that could be associated with the remedial activities proposed for this site. Site-specific work activities include drum removal, polychlorinated biphenyl (PCB)-impacted soils excavation, piezometer installation, *in-situ* soil vapor extraction (ISVE) and dual-phase extraction well installation, trenching, excavation and relocation of waste, grading/earthwork, cover preparation and installation, and drainage structure and access road construction. Both health and safety and hazard analysis for drum removal and PCB-impacted soils excavation have been discussed in the January 1999 Buried Drum Removal Plan and the April 1999 PCB-Impacted Soils Excavation Work Plan, respectively.

The Predesign SSP and the SSP Addendum have been prepared in compliance with the requirements of the OSHA Hazardous Waste Operation and Emergency Response Standards (29 CFR 1910.120) and other applicable OSHA regulations. Actual working conditions may require modification of the SSP Addendum. Except for minor modifications or in emergency situations, the Montgomery Watson Health and Safety Manager (HSM) or local Health and Safety Coordinator (HSC) must approve any modifications before they can be implemented. Written documentation of the change must be attached as additional addenda to this SSP Addendum.

2.0 SITE DESCRIPTION, HEALTH RISK AND ACCIDENT PREVENTION

2.1 SITE DESCRIPTION

The Site began operations in 1955, with reclamation of spent solvent waste. The Site accepted solvent mixtures containing alcohols, ketones, esters, chlorinateds, aromatics, aliphatics, and glycols that contained various residues. Other processes that have operated at the Site since 1955 include specialty chemical manufacturing in small batches, burning of still bottoms and non-reclaimable materials in incinerators (1965-1970), epoxidation and bromination operations, and storage and blending of waste streams for ACS' secondary fuel program.

Colfax Avenue, as shown in Figure 2-1, borders the Site on the east and northeast. An abandoned leg of the Chesapeake and Ohio Railway bisects the Site in a northwest-southeast direction, between the fenced ACS operating facility (north) and the fenced Off-Site Containment Area (south). ACS now owns these tracks and operates them strictly for holding and switching tank cars. The Site is bordered on the south by the Griffith Municipal Landfill (closed) and the abandoned Erie and Lackawanna Railway. On the north, the Site is bordered by the Grand Trunk Railroad and to the west by wetlands areas.

Approximately 33 acres are present within the Site, with the On-Site Containment Area (ACS operating facility) covering 15 acres, and the Off-Site Containment Area and Kapica-Pazmey Area (at the southern end of the Site, where a former drum recycler was located) covering 13 acres. The wetlands to the west of the Site make up approximately 5 acres.

2.2 EXISTING AREAS OF INVESTIGATION AND ASSOCIATED CHEMICAL HAZARDS

The primary identified source areas at the Site, presented on Figure 2-2, are:

1. On-Site Containment Area. According to the Record of Decision (ROD), approximately 400 drums of unknown sludges and semi-solids were suspected to be buried in the On-Site Containment Area. Subsequent geophysical surveys indicate that the On-Site Containment Area may contain between 1000 and 2500 drums.

2. Still Bottoms Pond Area. This area includes the former Still Bottoms Pond, treatment lagoon #1, and adjacent selected contaminated areas of the ACS facility. The Still Bottoms Pond Area received still bottoms waste from the solvent recovery process. The pond and lagoon were drained and filled with crushed drums containing sludge materials, along with miscellaneous rubble and debris.

3. Off-Site Containment Area and Kapica-Pazmey Area. The ROD reported that the Off-Site Containment Area received wastes that included 20,000 to 30,000 punctured, crushed drums, general refuse, on-site incinerator ash, and a tank truck containing solidified waste paint for disposal. The Materials Handling/LTTT Study, October 1997, indicates that up to 50,000 drums, predominantly crushed and non-intact, could be buried within the Off-Site Containment Area. The area adjacent to the Off-Site Containment Area to the west and south is contiguous with the City of Griffith Landfill and contains landfilled wastes. Kapica-Pazmey property has VOC- and lead-contaminated soil from direct disposal as a result of drum washing operations.

Contaminated groundwater has migrated off-site in the shallow aquifer. The areas of groundwater impact outside the barrier wall include an area to the north referred to as the North Area and an area to the south/southeast referred to as the South Area.

The chemicals of concern which impact the groundwater at the Site are volatile organic compounds (VOCs) including chlorinated hydrocarbons and benzene, and some semi-volatile organic compounds (SVOCs). Organic and inorganic chemical concentrations obtained during the Remedial Investigation/Fearability Study (RI/FS) are included as Appendix L of the Predesign SSP. The interim expedited remedial measures implemented in 1996 and 1997 have contained much of the groundwater plume, and have isolated the sources of groundwater contamination from further migration. Chemicals of concern that are present in the soils and waste at the Site are primarily VOCs, PCBs, and lead. Material Safety Data Sheets (MSDS) and ACS' site safety plan are included in Appendix B and Appendix J of the Predesign SSP, respectively.

2.3 PROPOSED ADDITIONAL INVESTIGATION/REMEDIATION ACTIVITIES

The proposed remediation activities planned for the Site include:

- Installation of ISVE and dual-phase extraction wells;
- Piezometer installation;
- Collection of groundwater elevations;
- Trench excavation through waste for ISVE system installation;
- Installation of a dewatering system (trenches and wells);
- Excavation and relocation of waste;
- Grading/earthwork;
- Cover preparation and installation;
- Drainage structures and access road construction;
- Drum removal; and
- PCB-impacted soils excavation.

2.4 SAFETY AND HEALTH RISK ANALYSIS

Chemical Toxicity Hazard. The potential toxic exposure hazard to site personnel associated with chemical contaminants which may be present at the areas described in Section 2.2 can be expressed in Threshold Limit Values-Time Weighted Averages (TLVs-TWAs), Permissible Exposure Limits (PELs), Short Term Exposure Limits (STELs), Recommended Exposure Limits (RELs), and/or Immediately Dangerous to Life of Health (IDLH) values, as established by the American Conference of Governmental Industrial Hygienists (ACGIH), OSHA, and/or the National Institute for Occupational Safety and Health (NIOSH). Appropriate definitions for these health-based values are as follows:

TLV-TWA: The TWA airborne concentration of a substance for a normal 8-hour work day and 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effects.

PEL: The TWA airborne concentration of a substance for a normal 8-hour workday and a 40-hour work week, to which workers may be exposed, day after day. PELs are OSHA-promulgated exposure standards (29 CFR 1910.100).

STEL: The TWA exposure that should not be exceeded at any time during a workday even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than four times per day.

REL: The TWA airborne concentration of a substance for up to a 10-hour exposure duration (unless otherwise noted) during a 40-hour workweek. RELs are established by NIOSH to reduce or eliminate adverse occupational health effects.

IDHL: The maximum airborne concentration of a substance which one could escape within 30 minutes without escape-impairing symptoms or any irreversible effects.

Available information regarding site contamination, occupational exposure limits for potential contaminants, including TWA and IDLH values and ionization potentials, is presented in Table 2-1. Table 2-2 summarizes odor thresholds, routes of exposure and symptoms. Table 2-3 presents the abbreviations used for symptoms.

Due to the invasive nature of this fieldwork, the varying types and concentrations of these potential hazards, proper monitoring during drilling, trenching, and/or sampling activities is a necessity. Specific monitoring and hazard assessment will be covered in Section 2.5 of this SSP Addendum.

Physical Hazards. Physical hazards anticipated during the field work include drill rig and excavation equipment operation (which can lead to struck-by or caught between hazards); potential underground and overhead utility lines; fire or explosion; noise; heat and/or cold stress; electrical hazards; mobile equipment traffic hazards; pinch hazards; and slip, trip and fall hazards. To prevent the hazard of drilling/excavation into underground power

cables or other utilities, all utilities will be marked prior to drilling. Montgomery Watson will contact and work with local utilities to assure, to the extent possible, that all underground utilities are identified and adequately marked. Standard drilling procedures, which prohibit drilling within 5 feet of marked underground utilities, or within 20 feet of overhead electrical hazards, will be followed for drilling operations.

Hazards associated with working in and around trenches and/or open excavations include: the potential for running soils, cave-ins, dislodged soil, lack of quick access and egress, and hazards associated with confined space entry. To limit these potential hazards, all work will be conducted in accordance with Title 29, CFR 1926 (Subpart P) Federal OSHA Construction Safety Standards – Excavations, Trenching, and Shoring and other corresponding State of Indiana OSHA requirements as they are applicable.

Levels of Personal Protection. Work conducted under this SSP Addendum will commence in **Level B** personal protective equipment (PPE), as described in Section 6.1. However, due to the varied nature of the waste, the contingency to either cease operation or downgrade Level C or Level D protection is included (Section 6.2). The downgrade will occur in the event that dust and/or atmospheric concentrations monitored during specific site activities are below predetermined levels of dust and/or toxic air contaminants established for upgrading protective equipment. Further explanation and criteria for downgrading the level of protection or ceasing operation are provided in Section 7.3 of this SSP Addendum

If monitoring indicates that either ceasing operation or a downgrade to Level C or Level D protection is warranted, it will be the responsibility of the Montgomery Watson On-Site Safety Officer (OSO) to either cease operations or communicate any changes in the level of PPE.

2.5 ACTIVITY HAZARD ANALYSIS

Hazards associated with drilling, excavation, and associated activities include equipment dangers; soil collapse; running soils; cave-ins; dislodged soil; lack of quick access and egress; hazards associated with confined space entry; pinch, slip, trip, and fall hazards; potential exposure to gas vapors; potential exposure to dust particulates carrying contaminants; utility contact; heat/cold stress; severe weather; and noise. During the advancement of any borings, drilling safety procedures will be observed and maintained. Severe weather considerations and general health and safety rules are included in Appendix D and Appendix F of the Predesign SSP, respectively.

Monitoring for dust conditions and the potential gases listed in Table 2-1 will be conducted to minimize exposure by early detection. If necessary, based on visual and instrumentation monitoring, the work site will be downgraded to Level C or Level D, or personnel will move away from the work site until levels drop to acceptable working levels. Heat/cold stress will be monitored depending upon ambient conditions. Temperature stress signs and

symptoms are included as Appendix E of the Predesign SSP. A guide to hazardous materials may also be found in the Predesign SSP as Appendix M.

Additionally, the following heavy equipment operation procedures will be followed:

- Before operating equipment in the vicinity of electrical power lines, the equipment operator will walk completely around the equipment to be used to determine the distance from the equipment to the nearest power line (the distance should be greater than 20 feet).

- Before conducting intrusive activity, the location will be adequately cleaned and leveled to accommodate the equipment to be used.

- Suitable storage for all tools, materials and supplies will be provided.

- Work areas and equipment platforms will be kept free of materials, obstructions and substances that could cause a surface to become slick or otherwise hazardous.

- All unnecessary personnel will be cleared from the area.

- No piece of heavy equipment will be left running and unattended.

- All heavy equipment scheduled for use at the Site will be inspected prior to use and be in safe operating condition.

- All field personnel will be required to wear, at a minimum, steel-toed boots, hard hats, hearing protection and safety glasses or goggles when working near heavy equipment. While excavation activities are being conducted in the waste, nitrile gloves (4-mil inner and 4-mil outer) and Tyvek® outer protective clothing will be worn. Respiratory protection may also be required when evidence of previously discarded medical wastes is observed. The types of respiratory protection are presented in Sections 6.2 of this SSP Addendum.

Open Excavations:

- If Montgomery Watson field personnel are to enter an open excavation, appropriate sloping, benching, shoring, or other mechanical means of sidewall support will be in place prior to entry. If evidence of medical wastes is encountered, disposable leather outer gloves will be worn to help prevent punctures. If soils are dry and dust conditions exist, it is recommended that respiratory protection be used to prevent inhalation exposure to potential biological airborne contaminants.

- If the excavation is determined to be a confined space, defined as enclosures having limited means for personnel entry and exit; by reason of location, size, or number of openings; and unfavorable natural ventilation which could contain or

produce dangerous air contaminants, flammable or explosive atmospheres; and/or oxygen deficiency, entry will be conducted in accordance with requirements established in Federal OSHA Standard: Title 29, Code of Federal Regulations, Part 1910.146 "Permit Required Confined Spaces." The OSO will be responsible to assure a Confined Space Entry Permit is filled out and all the associated monitoring and entry procedures are followed. A Confined Space Entry Permit is included as Attachment A.

Drum Handling:

Refer to the January 1999 Buried Drum Removal Plan for detailed hazard analysis and health and safety procedures.

While there is strong evidence indicating that the drummed material was paint and paint-related products, there is a possibility that those drums still intact contain other material. Due to the inherent hazards of handling old drums, the following safety precautions shall be followed:

1. Only the minimum number of people needed to do the work will be allowed in the exclusion zone. At this time it is estimated that the exclusion zone will be set at 50 feet from the access to the work area and will encompass the entire work area.

2. The backhoe operator using the drum grappler will work slowly and deliberately to minimize damage to the drums being moved or drum contents.

3. The backhoe operator shall inform the site supervisor of any labels or other indicators of drum contents that he/she finds along the way.

4. Hazards associated with the movement of drums will be communicated to all site personnel each day during the tailgate safety meeting.

5. A minimum of Level B personal protective equipment (PPE) to start for people inside the exclusion zone (Section 6.3).

6. Close coordination between the backhoe operator and the on-site safety officer (OSO) conducting the air monitoring. Stopping work or changing PPE according to air monitoring results (see Section 7.0).

7. United States Department of Transportation (US DOT) specification overpack drums and absorbent will be available in the event that a drum containing liquid begins to leak.

8. Any area where a liquid release occurs shall be taped off, sampled and containerized in a manner consistent with the nature of the released material. Disposal arrangements will be made after sampling results have been obtained.

9. When drums are being moved that are still intact a fire watch with a minimum of two 10-pound ABC fire extinguishers will be on site in case of an accidental spill and spark resulting in fire.

10. When opening still intact drums for sampling, the following shall be implemented:

    - Observation and notation to the site supervisor by the backhoe operator whether it seems there is any free liquid inside the drums when he/she was handling them. Based on this observation and any labeling, the level of PPE required during drum opening will be determined. Low or no likelihood of liquids and some labeling or indication that the material is indeed paint will result in Level C PPE. High likelihood of liquid waste and no good indication of contents will result in Level B PPE.

    - A new exclusion zone shall be established around the roll-off bin containing the intact drums. It is estimated that this exclusion zone will be a minimum of 50 feet in diameter.

    - Only the personnel assigned to active sampling will be permitted in the exclusion zone.

    - A fire watch will be stationed outside of the exclusion zone.

    - Use of a face shield in addition to the Level C or Level B PPE ensemble.

    - Consideration of the use of non-sparking tools to open ring or bung tops.

    - Consideration of punching a hole in the drum with a remote device to release any pressure and allow for remote air sampling prior to personnel collecting samples – if free liquid is likely to be inside.

3.0 ASSIGNMENT OF RESPONSIBILITIES

Assignment of responsibilities for development, coordination and implementation of the Predesign SSP and SSP Addendum is essential for proper administration of the plan's requirements. Implementation of the Predesign SSP and SSP Addendum will be accomplished through an integrated effort of the following personnel:

Team Member	Work Assignment
Project Coordinator	Joseph D. Adams, Jr.
Health and Safety Coordinator	Brian Griesemer
On-Site Safety Officer	Lee Orosz

3.1 PROJECT COORDINATOR (PC)

The PC is primarily responsible for safety performance of the project and is the central point of contact with the ACS RD/RA Executive Committee. Should a health and safety issue develop in the performance of the field activities, the PC will contact the ACS RD/RA Executive Committee and the Montgomery Watson HSC.

3.2 HEALTH AND SAFETY COORDINATOR (HSC)

The HSC is responsible for preparation of the Predesign SSP and SSP Addendum. The HSC will ensure that the Predesign SSP and SSP Addendum comply with OSHA standards and site-specific health and safety requirements based on known or anticipated health and safety concerns. If necessary, the OSO can modify the SSP Addendum to accommodate on-site changes that may affect safety. The OSO will confer with the HSC on all modifications to the SSP Addendum. The HSC will be available for consultation when required. The HSC may visit the site during field activities to perform a site safety audit but will not remain on site throughout the remediation. A copy of the Site Safety Checklist is included as Appendix A of the Predesign SSP.

3.3 ON-SITE SAFETY OFFICER (OSO)

The OSO is responsible for the implementation of the SSP Addendum. The OSO has the responsibility and authority to halt or to modify any work condition or remove personnel from the Site if he/she considers conditions to be unsafe. The OSO will be the main contact in any on-site emergency situation and will direct all field activities. The OSO will ensure that all on-site Montgomery Watson personnel understand and comply with site safety requirements. If the OSO observes Montgomery Watson or subcontractor personnel deviating from standard health and safety practices, an "Incident Report" form will be

completed. A copy of the report will be submitted to the HSC and, if applicable, the subcontractor's company. Except for minor changes or emergencies, the OSO can modify the SSP Addendum requirements only after consultation with the approval by the HSC. The OSO or an assigned designee will be on site at all times during field activities to observe and audit the various fieldwork zones throughout the remediation.

3.4 FIELD STAFF

All Montgomery Watson field staff are responsible for understanding and complying with all requirements of the Predesign SSP and SSP Addendum. Every morning before the start of field activities, a tailgate safety meeting will be conducted to instruct field staff on the Predesign SSP and SSP Addendum requirements. During this meeting, site safety concerns and questions can be directed to the OSO by field staff. Each worker must sign and date a "Personal Acknowledgement Form" (Attachment B) stating that he/she understands the contents of the Predesign SSP and SSP Addendum.

3.5 NOTIFICATION REQUIREMENTS

Unanticipated field conditions will occasionally require modifications to the SSP Addendum. Notification and/or approval procedures will be dependent on actual field conditions. Conditions which require a change in the level of PPE or respiratory protection recommendation for this site should be reported to the HSC or HSM and recorded on the "Tailgate Safety Meeting Form" (Attachment C) and attached as additional addenda to the Predesign SSP. Minor changes not affecting the degree of protection can be implemented by the OSO. These changes will be documented and sufficiently justified in the field logbook.

The OSO will stop all field activities and contact the HSC or HSM under the following conditions:

1. Any activity requiring an upgrade to Level A protection;

2. Any IDLH activity, as defined by NIOSH;

3. Any proposed entry by Montgomery Watson personnel into a confined space; or

4. Any physical hazards where an exposure under reasonable circumstances could lead to permanent injury or possible death.

4.0 MEDICAL SURVEILLANCE AND TRAINING

4.1 EMERGENCY MEDICAL ASSISTANCE AND FIRST-AID EQUIPMENT

Prior to work startup, the OSO will discuss the emergency medical assistance network that has been established for the Site with all personnel assigned to the field project. Locations of phones, fire extinguishers, first-aid kits, emergency telephone numbers, etc. are identified in the "Emergency Assistance Information" form (Attachment D). A map showing directions to the nearest hospital location will be provided to all field personnel. A map to the hospital is included as Figure 4-1. Attachment D and the emergency route map will be clearly posted at each work site. A designated safety vehicle will be on site and available at all times for a medical or safety emergency. The OSO or personnel designated by the OSO will be responsible for the availability and use of the safety vehicle.

The OSO and key field staff will be certified to render first aid and cardiopulmonary resuscitation (CPR) prior to the initiation of field activities. A first-aid kit will be available at the Site for use by trained personnel. An adequate supply of fresh water or portable emergency eyewash will be available at each work site. Field emergency response procedures and first aid are included as Appendix H and Appendix I of the Predesign SSP, respectively.

5.0 SITE CONTROL

Site control requires the establishments of a regulated area, designated work zones, evacuation protocol and site security. The Site property is fenced around the entire perimeter, and access is restricted. All work zones will be further restricted using pylons or stakes and caution tape. Disposal containers for personal protective clothing and wash basins for personnel decontamination will be positioned at the exit point of the exclusion zone. Decontamination procedures are included as Appendix G of the Predesign SSP.

During site activities, the contractor will control access to the Site. Access will be restricted to Site visitors associated with the remedial action who have received the 40-hour Health and Safety and necessary 8-hour refresher training required for entry onto a Superfund site. All visitors entering the Site will sign in with the contractor, and by signing in, the visitor will be providing verification that they are authorized to access a Superfund site.

After site work is complete, the perimeter fencing will continue to restrict site access.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE will be required during the course of the work at the Site. PPE selection will be based primarily on hazard assessment data and work task requirements. Prior to entry, each work zone will be monitored for potentially hazardous contaminants using a photoionization detector (PID) equipped with a 10.2 or 10.6 eV lamp or equivalent. During intrusive activities conducted in the unsaturated zone, an Exotox 50® portable gas monitor or equivalent, Dräger pump, and MINIRAM will also be used to identify potential exposure to contaminants.

The Exotox 50® will detect oxygen, carbon monoxide and hydrogen sulfide concentrations and provide lower explosive limit (LEL) percentages. The PID and Exotox 50® will be calibrated in the field at the beginning of each workday according to manufacturer instructions, using the appropriate calibration span gas where applicable. Following calibration, a reading will be recorded using upwind background measurements. At the end of each workday, a reading will be taken using upwind background measurements to determine calibration variations. All calibration information will be recorded on an "Equipment Calibration" form.

Lead is a contaminant of concern at the Site. The Occupational Safety and Health Administration (OSHA) Lead in Construction Standard (29 CFR 1926.62) applies to the work anticipated at ACS. For this reason, the following protocols will be added to the field program for this site:

- Site personnel will be required to attend a lead hazards awareness training session presenting hazard awareness information (i.e., routes of exposure, acute/chronic health effects) and all key elements of the OSHA Lead in Construction Standard.

- Site personnel will be required to undergo project specific blood lead testing (i.e., blood-lead level and zinc protoporphyrin). Testing will be conducted prior to the start of work, at an interim point in the project, and upon completion of the project. This testing schedule assumes that the field work will last no more than two months. Testing will be arranged through Greaney Medical Group Work Care, a Montgomery Medical Monitoring Provider. Employees need to contact Carmen Rodriguez at (800) 455-6155 ext. 113 to arrange for an appointment for the testing. Project supervisors shall ensure that their personnel have made adequate time to obtain the test prior to start of work.

- Site-specific air monitoring (e.g., industrial hygiene sampling) will be conducted to quantitatively evaluate airborne lead exposures. The monitoring will target site workers with the highest likely exposure. See Section 7.0 for additional monitoring information.

- It is not anticipated that workers will be exposed above the lead PEL or action level. If the action level/PEL is exceeded, engineering controls will be reassessed (i.e., the adequacy of wetting measures, etc.), dedicated change areas and shower facilities will be installed for use by any/all site personnel (at exposure levels above the PEL), lead work area signage will be posted (at exposure levels above the PEL), and the level of respiratory protection and personal protective equipment will be reevaluated.

- Initial levels of personal protective equipment will be selected based upon the expected levels of airborne lead (i.e., anticipated to be no greater than ten times the PEL value). Refer to Section 7.0.

Time Integrated Industrial Hygiene Sampling (IH sampling). This type of sampling is used to evaluate personal exposures to lead containing dust.

- In accordance with the Lead in Construction Standard (29 CFR 1926.62), IH sampling will be conducted as part of an initial exposure assessment and periodically during the conduct of overall task activities. It is anticipated that sampling will be conducted at work initiation (first two field days), and then at weekly intervals (one day) for the duration of the soils excavation/trenching activities. Employees considered to have the greatest potential for lead exposure will be selected for monitoring. Montgomery Watson oversight personnel will not be part of the work initiation sampling, but will be included later if the work initiation sampling indicates an exceedance of the lead action limit. When IH sampling is conducted, the worker(s) with the ability to have the highest potential for exposure will be selected at each site for personal sampling (i.e., trencher operator). During each sampling event, full-shift sampling shall be conducted on one or two workers (expected to have the highest potential exposure levels). Samples shall be collected and analyzed in accordance with NIOSH Method 7105 Lead by GFAAS, OSHA Method ID 121 or equivalent (i.e., NIOSH Method 7300 – Elements by ICP if adding other metals like As, Cd, Cr etc.). An appropriate number of quality assurance (QA) and blank samples shall be prepared and analyzed (these are prescribed in the analytical methods). Analyses shall be performed by an American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing Program accredited laboratory. Analytical turn around time (TAT) for initial exposure assessment samples will be 24 hours. Subsequent IH samples for lead will have a standard 5-day TAT. Personal IH sampling will be conducted by an industrial hygienist.

A Dräger pump will be used to determine benzene, chloroform, 1,1-dichloroethene, and carbon tetrachloride exposures.

Dust conditions will be monitored both visually and with a direct read instrument (MINIRAM) by Montgomery Watson personnel.

The breathing zone during excavation, drilling, and sampling activities will be monitored with the PID, Dräger pump, MINIRAM, and Exotox 50®. The Exotox 50® portable gas monitor will also be used to monitor the LEL and oxygen levels in and around excavations.

Based upon Site history, the initial level of protection for all field activities will be Level B. Provisions are made in Section 7.3 for downgrading the level of protection to Level C or D or evacuating the Site based upon oxygen deficiency, flammability, dust conditions, or organic vapors.

6.1 LEVEL D PPE

Montgomery Watson personnel working in Level D shall wear, as a minimum:

- Coveralls made of cotton or disposable, chemical-resistant Tyvek®. Polycoated or SARANEX®-laminated Tyvek® coveralls will be worn where the potential for contact with contaminated liquids. Protective aprons may be allowed for sampling purposes, except where medical wastes have been identified, once sufficient sampling has occurred to evaluate the potential for contaminant exposure. The HSC or HSM should be consulted before implementing the use of aprons for sampling.

- Gloves (outer): chemical-resistant, 4-mil, nitrile. When contact with contaminants is anticipated, chemical-resistant, 22-mil, nitrile gloves will be worn. If evidence of medical wastes are encountered, disposable leather outer gloves should also be used.

- Gloves (inner): chemical-resistant, 4-mil, nitrile.

- Boots: leather or chemical-resistant; steel-toed (all field activities).

- Hard hat (all field activities).

- Hearing protection when near heavy equipment.

- Safety glasses or goggles (all field activities).

6.2 LEVEL C PPE

When air monitoring information, dust conditions or previously obtained site information dictates that a particular site is a Level C protection area, Montgomery Watson personnel shall wear, as a minimum:

- Full-face or half-face air-purifying respirator equipped with National Institute for Occupational Safety and Health (NIOSH)-approved organic vapor (OV) cartridges if organic vapors are encountered. Highly toxic particulate (HEPA or P100) cartridges (NIOSH approved) will be used in conjunction with the respirators if sufficient dust levels are encountered. Where the main concern is biological airborne contaminants associated with the potential inhalation exposure to medical wastes encountered during trenching though wastes, dust masks (3M 8710) can be used in lieu of the HEPA or P100 cartridges. Safety glasses or goggles will be worn during all field activities when half-face respirators are used. Cartridges shall be changed every 4-hours of active use of if breakthrough occurs, which ever comes first.

- Coveralls made of cotton or disposable, chemical-resistant Tyvek®. Polycoated or SARANEX®-laminated Tyvek® coveralls will be worn where the potential for contact with contaminated liquids/soils exists (seams, arm and leg openings will be secured with duct tape). Protective aprons may be allowed for sampling purposes once sufficient sampling has occurred to evaluate the potential for contaminant exposure. The HSC should be consulted before implementing the use of aprons for sampling.

- Gloves (outer): chemical-resistant, 4-mil, nitrile. When contact with contaminants is anticipated, chemical-resistant, 22-mil, nitrile gloves will be worn. If evidence of medical wastes is encountered, disposable leather outer gloves should also be used.

- Glovers (inner): chemical-resistant, 4-mil, nitrile.

- Boots: chemical-resistant, steel-toed (all field activities).

- Hard hat (all field activities)

- Hearing protection when near heavy equipment.

- Safety glasses or goggles if half-face respirator is used.

6.3 LEVEL B PPE

Montgomery Watson personnel shall wear the equivalent of Level C PPE ensemble with the exception of the respirator. For Level B, a supplied air ensemble (either air-line or self-contained breathing apparatus) shall replace the air purifying respirator.

6.4 RESPIRATOR SELECTION AND FIT TEST

The OSO is responsible for verifying that all on-site Montgomery Watson field personnel have been fit-tested for the applicable respirators prior to working in Level C or B protection at the Site. Montgomery Watson air-purifying respirator fit test protocol is presented in Appendix N of the Predesign SSP. The OSO or HSC will maintain a record documenting the date, size, brand, and model number of the air-purifying respirator for each site worker using the "Personal Acknowledgement Form" found in Attachment B of this SSP Addendum. Contact lenses can be worn when using a full-face respirator in the exclusion zone if they are gas permeable or soft lenses. Site workers who wear spectacles and are working in Level C or B PPE in the exclusion zone will be supplied with spectacles specially designed for respirators.

7.0 HAZARD ASSESSMENT

Hazard assessment is essential in determining the hazard control measures that need to be implemented during the site investigation. Hazard assessment is an ongoing process and involves characterization of the chemical, physical, biological and other safety hazards at the site.

7.1 SITE SURVEY

Prior to initiation of work activities, the OSO shall conduct a site survey to identify safety hazards and determine appropriate control measures. Hazards may include, but are not limited to, underground utilities and/or storage tanks, product transfer lines, ground traffic, overhead power lines and current weather conditions, such as excessive heat or cold conditions, lightening, etc.

7.2 AIR MONITORING

The main objective of atmospheric monitoring is to assess the inhalation and explosion hazards presented to site personnel. Based on soil contaminant concentrations reported in the September 1991 *Remedial Investigation Report: Baseline Risk Assessment*, Table 7-1 lists the atmospheric air monitoring required during construction activities.

During site activities, air monitoring will be conducted using a PID, Dräger pump, MINIRAM, and Exotox 50® or equivalent:

PID. Each work zone shall be monitored for organic vapors using a PID equipped with a 10.2 or 10.6 eV lamp or equivalent, as described in Section 6.0. The PID will be calibrated daily and operated in the 0 to 2- parts per million (ppm) range. Organic vapor levels will be measured upwind of the work zone to determine a background reading on a daily basis. Readings in the breathing zone of site workers (2 to 5 feet above the ground) will be taken at 30-minute intervals, at a minimum. More frequent monitoring will be conducted if readings above background are recorded. All PID readings will be recorded in a field log book by the OSO or designated Montgomery Watson personnel.

Exotox 50.® Each work zone shall be monitored for potential gases (specifically oxygen and flammables) using an Exotox 50®, as described in Section 6.0. Vapor levels will be measured upwind of the work zone to determine a background reading. Readings in the breathing zone of site workers (2 to 5 feet above the ground) and during excavation activities from within the excavation will be taken at 30-minute intervals, at a minimum. More frequent monitoring will be conducted if elevated readings are recorded. All Exotox 50® readings will be recorded in the field log book by the OSO or his/her designee. Exotox 50® monitoring of each work zone will be conducted as long as drilling or sampling

operations are in progress and personnel are within the defined boundaries of the work zone.

Dräger Pump. A Dräger pump equipped with benzene (tube #8101231), chloroform (tube #6728861), 1,1-dichloroethene (tube #8101721), and carbon tetrachloride (tube #8101021) Dräger tubes with a response range of 0.5 to 10, 0.5 to 5, and 2 to 15 ppm, will also be used to monitor the site. Benzene readings in the breathing zone of site workers (2 to 5 feet above the ground) will be taken during intrusive activities when PID readings above background are recorded. All Dräger readings will be recorded in the field log book by the OSO or his designee.

MINIRAM. Dust conditions will be both visually monitored and measured with a MINIRAM by Montgomery Watson personnel. Readings will be taken every 30 minutes until sufficient data have been collected to warrant a less frequent monitoring interval. Attachment E contains the dust exposure calculation worksheets that compute the dust action level for each of the construction areas. The OSO or his/her designee will log visual observations and readings obtained from the MINIRAM in the field logbook as well as monitor dust levels as compared to the calculated action levels.

7.3 ACTION LEVELS FOR CEASING OPERATION OR DOWNGRADING

The decision to cease operation or downgrade the level of protection will be based on readings of organic vapors and dust conditions. Situations dictating ceasing operation or selection of downgraded levels and the corresponding action to be taken are indicated in Table 7-1 and Attachment E.

The HSC or PC will be notified of any stoppages of work or any downgrade in PPE in accordance with Section 3.5.

JMS/jms/BSD/KAW/TAB
\\CHI1_SERVER\JOBS\1252\042\28\125204228a139.doc
1252042.281201

Table 2-1

TOXICITY INFORMATION AND OCCUPATIONAL HEALTH GUIDELINES WORKSHEET

Chemical Compound	NIOSH-ACGIH TWA (for air) (ppm/[mg/m^3])	OSHA IDLH (for air) (ppm/[mg/m^3])	Ionization Potential
Metals/Common Ions			
Aluminum	-/-	-/-	-
Antimony	-/0.5	-/80	NA
Arsenic	-/C 0.002	-/100	NA
Barium	-/0.5	-/1,100	-
Cadmium	-/0.2	-/50	NA
Calcium	-/-	-/-	-
Chromium	-/0.5	NA	NA
Copper	-/1	NA	NA
Cyanide	-/C 5	-/50	NA
Hydrogen Cyanide	C4.7/C5	50/-	13.60
Hydrogen Sulfide	10/-	300/-	10.46
Iron	-/5	NA	NA
Lead	-/0.05	-/700	NA
Magnesium	-/10	NA	NA
Manganese	-/1	NA	NA
Mercury (vapor)	-/0.05	-/28	-
Nickel	-/0.015	NA	NA
Polychlorinated Biphenyls (PCBs)	-/0.001	-/5 Ca	-
Potassium, Dissolved	-/-	-/-	-
Selenium	-/0.2	-/-	NA
Silver	-/0.01	NA	NA
Sodium	-/-	-/-	-
Thallium	-/0.1	-/20	NA
Zinc	-/5	-/-	NA
Volatile Compounds			
Benzene	0.5/-	3,000/-	9.24
Chloroform	2/-	1,000/-	11.42
1,2-Dichloroethene	200/-	4,000/-	9.65
Ethylbenzene	100/-	2,000/-	8.76
Toluene	100/-	2,000/-	8.82
Trichloroethene	25/-	1,000/-	9.45
Xylenes	100/-	1,000/-	8.56
Acid Fraction			
Phenol	5, C 15.6/-	250/-	8.50
Base/Neutral Fraction			
Acenaphthylene	-/-	-/-	-
Acenaphthene	-/-	-/-	-
Acetone	250/-	20,000/-	9.69

Table 2-1

TOXICITY INFORMATION AND OCCUPATIONAL HEALTH GUIDELINES WORKSHEET

Chemical Compound	NIOSH-ACGIH TWA (for air) (ppm/[mg/m^3])	OSHA IDLH (for air) (ppm/[mg/m^3])	Ionization Potential
Base/Neutral Fraction (Continued)			
Anthracene	-/0.2	-/-	-
Benzo(a)anthracene	-/-	-/-	-
Benzo(b)fluoranthene	-/-	-/-	-
Benzo(k)fluoranthene	-/-	-/-	-
Benzo(g,h,i)perylene	-/-	-/-	-
Benzo(a)pyrene	-/0.2	-/-	-
Benzyl Alcohol	-/-	-/-	-
Bis(2-chloroethoxy)methane	-/-	-/-	-
Bis(2-chloroethyl)ether	5/-	-/-	-
Bis(2-chloroisopropyl)ether	-/-	-/-	-
Bis(2-ethylhexyl)phthalate	-/-	-/-	-
4-Bromophenyl Phenyl Ether	-/-	-/-	-
Butyl Benzyl Phthalate	-/-	-/-	-
4-Chloroanaline	-/-	-/-	-
2-Chloronaphthalene	-/2	-/-	-
4-Chlorophenyl Phenyl Ether	-/-	-/-	-
Chrysene	-/0.2	-/-	-
Dibenzo(a,h)anthracene	-/-	-/-	-
Dibenzofuran	-/0.5	-/-	-
Di-n-butyl-phthalate	-/5	-/-	-
1,2-Dichlorobenzene (ortho)	50/-	1,000/-	9.06
1,3-Dichlorobenzene	-/-	-/-	-
1,4-Dichlorobenzene (para)	75/-	1,000/-	8.98
3,3-Dichlorobenzidine	-/-	-/-	-
Dimethylphthalate	-/5	-/9,300	9.64
2,4-Dinitrotoluene	-/1.5	-/200	-
2,6-Dinitrotoluene	-/1.5	-/200	-
Di-n-Octyl Phthalate	-/-	-/-	-
Fluoranthene	-/-	-/-	-
Fluorene	-/-	-/-	-
Hexachlorobenzene	-/0.025	-/-	-
Hexachlorobutadiene	0.02/-	-/-	-
Hexachlorocyclopentadiene	0.01/-	-/-	-
Hexachloroethane	1/-	300/-	11.22
Indeno(1,2,3-cd)pyrene	-/-	-/-	-
Isophorone	4/-	800/-	9.07
2-Methylnaphthalene	-/-	-/-	-
Naphthalene	10/-	500/-	8.12
2-Nitroanaline (meta)	-/-	-/-	-
3-Nitroanaline (ortho)	-/-	-/-	-
4-Nitroanaline (para)	-/3	-/300	8.85
Nitrobenzene	1/-	200/-	9.92
N-Nitrosodiphenylamine	-/-	-/-	-
N-Nitroso-dipropylamine	-/-	-/-	-
Phenanthrene	-/0.02	-/-	-
Pyrene	-/0.2	-/-	-
1,2,4-Trichlorobenzene	C 5/-	-/-	-

Table 2-1

TOXICITY INFORMATION AND OCCUPATIONAL HEALTH GUIDELINES WORKSHEET

Chemical Compound	NIOSH-ACGIH TWA (for air) (ppm/[mg/m^3])	OSHA IDLH (for air) (ppm/[mg/m^3])	Ionization Potential
Pesticides/Herbicides			
Alachlor (Lasso)	0.01/0.11	-/-	-
Atrazine (Aatrex)	-/5	-/-	-
Bivert PH	100/-	-/-	-
Chlorpyrifos (Dursban)	-/-	-/-	-
Cyanazine (Bladex)	50/10	-/-	-
2,4-DP (Visko-Rhap)	-/-	-/-	-
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	-/10	-/500	-
EPTC (Eptam)	-/-	-/-	-
Glyphosphate (Roundup)	NE	NE	-
Imazapyr (Arsenal)	5/-	-/-	-
Metolachlor (Dual)	-/-	-/-	-
Metribuzin (Sencor)	-/5	-/-	-
Picloran (Tordon)	-/5	-/-	-
2,4,5-Trichlorophenoxy Acetic Acid (2,4,5-T)	-/10	-/-	-
Trifluralin (Treflan)	75/-	-/-	-

- Indicates no information available.
C = Ceiling limit.
Ca = Potential carcinogen.
mg/m^3 = Micrograms per cubic meter.
NA = Not applicable.
NE = No evidence to indicate upper limit applicable.
ppm = Parts per million.

Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists
IDLH = Immediately Dangerous to Life or Health
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
TWA = Time Weighted Average

References:

1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Limits Agents.
NIOSH Pocket Guide to Chemical Hazards.
Photovac Incorporated Technical Bulletin No. 11.
Personnel Protection and Safety, EPA Course 165.2 (manual).
The Condensed Chemical Dictionary, 10th Ed., 1981.
Sax's Dangerous Properties of Industrial Materials, 8th Ed.

Table 2-2

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Metals/Common Ions				
Aluminum	-	-	-	-
Antimony	-	-	Inh, Con	Irrit nose, throat, mouth; cough; dizz; head; nau, vomit, diarr; stomach cramps; insom; anor; irrit skin; unable to smell properly; cardiac abnormalities in antimony trichloride exposures
Arsenic	NA	Odorless	Inh, Abs, Ing, Con	Ulceration of nasal septum, derm, GI disturbances, peri neur, resp irrit, hyperpigmentation of skin, [carc]
Barium	NA	Odorless	Inh, Ing, Con	Upper resp irrit, gastroenteritis; musc spasm; slow pulse, extrasystoles; hypokalemia; irrit eyes, skin; skin burns
Cadmium	NA	Odorless	Inh, Ing	Pulm edema, dysp, cough, tight chest, subs pain; head; chills, musc aches; nau, vomit, diarr; emphy, prot, anos, mild anemia; [carc]
Calcium	-	-	-	-
Chromium	NA	Odorless	Inh, Ing	Histologic fibrosis of lungs
Copper	NA	Odorless	Inh, Ing, Con	Irrit nasal muc memb, pharynx; nasal perforation; eye irrit; metallic taste; derm; in animals: lung, liver, kidney, damage; anemia
Cyanide	-	Almond-like	Inh, Abs, Ing, Con	Asphy and death can occur; weak, head, conf; nau, vomit; incr rate resp; slow gasping resp; irrit eyes, skin
Hydrogen Cyanide	-	Bitter, almond-like	Inh, Abs, Ing, Con	Asphy and death at high levels; weak, head, conf; nau, vomit; incr rate and depth of respiration or respiration slow and gasping

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Metals/Common Ions (Continued)				
Hydrogen Sulfide	0.001-0.13	Rotten eggs	Inh, Ing, Con	Apnea, coma, convuls; irrit eyes: conj, pain, lac, photo, corneal vesic; irrit resp sys; dizz; head; ftg; irrity; insom; GI dist
Iron	-	-	Inh	-
Lead	NA	Odorless	Inh, Ing, Con	Weak, lass, insom; facial pallor; pal eye, anor, low-wgt, malnut; constip, abdom pain, colic; anemia; gingival lead line; tremor; para wrist, ankles; encephalopathy; nephropathy; irrit eyes; hypotension
Magnesium	-	-	Inh, Con	Irrit eyes, nose; metal fume fever; cough, chest pain, flu-like fever
Manganese	-	-	Inh, Ing	Parkinson's; asthenia, insom, mental conf; metal fume fever; dry throat, cough, tight chest, dysp, flu-like fever; low-back pain; vomit; mal; ftg
Mercury (vapor)	NA	Odorless	Inh, Abs, Con	Cough, chest pain, dysp, bron pneuitis; tremor, insom; irrity, indecision; head, ftg, weak; stomatitis, salv; GI dist, anor, low-wgt; prot; irrit eyes, skin
Nickel	NA	Odorless	Inh, Ing, Con	Head, verti; nau, vomit, epigastric pain; substernal pain; cough, hyperpnea; cyan; weak; leucyt, pneuitis; delirium, convuls; [carc]
Polychlorinated Biphenyls (PCBs)	-	Mild, hydrocarbon odor	Inh, Abs, Ing, Con	Irrit eyes, skin; acne-form derm; [carc]; in animals: liver damage
Potassium, Dissolved	-	-	-	-
Selenium	-	-	Inh, Abs, Ing, Con	Irrit eyes, nose, throat; vis dist; head; chills, fever; dysp, bron; metallic taste, garlic breath, GI dist; derm; skin, eye burns; in animals; anemia; liver, kidney damage

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Metals/Common Ions (Continued)				
Silver	-	-	Inh, Ing, Con	Blue-gray eyes, nasal septum, throat, skin; irrit skin, ulceration; GI dist
Sodium	-	-	-	-
Thallium	-	Varies	Inh, Abs, Ing, Con	Nau, diarr, abdom pain, vomit; ptosis, strabismus; peri neuritis, tremor; retster tightness, chest pain, pulm edema; sez, chorea, psychosis, liver, kidney damage; alopecia; pares legs
Zinc	NA	Odorless	Inh	Sweet, metallic taste; dry throat, cough; chills, fever; tight chest, dysp, rales, reduced pulm func; head; blurred vision; musc cramps, low back pain; nau, vomit; ftg, lass, mal
Volatile Compounds				
Benzene	34-119	Aromatic, sweet, solventy	Inh, Abs, Ing, Con	Irrit eyes, nose, resp sys; gidd; head, nau, staggered gait; ftg, anor, lass; derm; bone marrow depres; [carc]
Chloroform	133-276	Sweet, suffocating, pleasant	Inh, Ing, Con	Dizz, mental dullness, nau, disorientation; head, ftg; anes; hepatomegaly; irrit eyes, skin; [carc]
1,2-Dichloroethene	0.08-17	Slightly acrid, chloroform-like	Inh, Ing, Con	Irrit eyes, resp sys; CNS depres
Ethylbenzene	0.092-0.60	Aromatic, oily, solventy	Inh, Ing, Con	Irrit eyes, muc memb; head; derm; narco, coma
Toluene	0.16-37	Sweet, pungent, benzene-like, sour, burnt	Inh, Abs, Ing, Con	Ftg, weak; conf, euph, dizz, head; dilated pupils, lac; ner, musc ftg, insom; pares; derm

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Volatile Compounds (Continued)				
Trichloroethene	82	Chloroform-like, ether, solventy	Inh, Ing, Con	Head, verti; vis dist, tremors, som, nau, vomit; irrit eyes; derm; card arrhy, pares; [carc]
Xylenes	0.081-40	Sweet, aromatic	Inh, Abs, Ing, Con	Dizz, excitement, drow, inco, staggering gait; irrit eyes, nose, throat; corneal vacuolization; anor, nau, vomit, abdom pain; derm
Acid Fraction				
Phenol	0.0045-1	Sweet, acrid	Inh, Abs, Ing, Con	Irrit eyes, nose, throat; anor, low-wgt; weak, musc ache, pain; dark urine; cyan; liver, kidney damage; skin burns; derm; ochronosis; tremor, convuls, twitch
Base/Neutral Fraction				
Acenaphthylene	-	-	-	-
Acenaphthene	-	-	-	Skin, eye and muc memb irrit; vomit
Acetone	3.6-699	Fragrant, mint-like	Inh, Ing, Con	Irrit eyes, nose, throat; head, dizz; derm
Anthracene	-	-	-	Skin irrit and allergen; known carcinogen
Benzo(a)anthracene	-	-	-	Known carcinogen
Benzo(b)fluoranthene	-	-	-	Moderately toxic
Benzo(k)fluoranthene	-	-	-	Moderately toxic
Benzo(g,h,i)perylene	-	-	-	-
Benzo(a)pyrene	-	-	Inh	Toxic; suspected carcinogen

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Base/Neutral Fraction (Continued)				
Benzyl Alcohol	-	Slight odor	-	Moderately toxic
Bis(2-chloroethoxy)methane	-	-	Inh, Ing	Toxic; strong irritant
Bis(2-chloroethyl)ether	-	Sweet, chloroform-like	Inh, Abs, Ing	Toxic; strong irritant
Bis(2-chloroisopropyl)ether	-	-	-	-
Bis(2-ethylhexyl)phthalate	-	-	-	-
4-Bromophenyl Phenyl Ether	-	-	-	-
Butyl Benzyl Phthalate	-	Slight odor	-	Low toxicity
4-Chloroanaline	-	-	Inh, Ing	Moderately toxic
2-Chloronaphthalene	-	-	Inh, Abs, Ing	Toxic; strong irritant
4-Chlorophenyl Phenyl Ether	-	-	-	-
Chrysene	-	-	-	Toxic; carcinogenic agent
Dibenzo(a,h)anthracene	-	-	-	-
Dibenzofuran	-	Geranium-like	Inh	Toxic
Di-n-butyl-phthalate	NA	Odorless	-	Toxic
1,2-Dichlorobenzene (ortho)	0.70	Pleasant, aromatic, camphor-like	Inh, Abs, Ing, Con	Irrit nose, eyes; liver, kidney damage; skin blister
1,3-Dichlorobenzene	-	-	-	-

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Base/Neutral Fraction (Continued)				
1,4-Dichlorobenzene (para)	0.12	Camphor-like, mothballs	Inh, Ing, Con	Head; eye irrit, swell periorb; profuse rhinitis; anor, nau, vomit; low-wgt, jaun, cirr; [carc]; in animals: liver, kidney damage
3,3-Dichlorobenzidine	-	-	Abs	Causes tumors in animals; worker exposure should be minimized; a known carcinogen
Dimethyl Phthalate	-	Slightly aromatic	Inh, Ing, Con	Irrit upper resp sys, stomach pain
2,4-Dinitrotoluene	-	Characteristic	Inh, Abs, Ing, Con	Anoxia, cyan; anemia, jaun; [carc]
2,6-Dinitrotoluene	-	Characteristic	Inh, Abs, Ing, Con	Anoxia, cyan; anemia, jaun; [carc]
Di-n-Octyl Phthalate	-	Slight odor	-	Low toxicity
Fluoranthene	-	-	-	Moderately toxic
Fluorene	-	-	-	-
Hexachlorobenzene	-	-	Ing	Moderately toxic
Hexachlorobutadiene	-	Mild odor	Inh, Ing	Toxic; a suspected carcinogen
Hexachlorocyclopentadiene	-	Pungent	Inh, Abs, Ing	Highly toxic
Hexachloroethane	-	Camphor-like	Inh, Abs, Ing, Con	Irrit eyes; [carc]
Indeno(1,2,3-cd)pyrene	-	-	-	-
Isophorone	0.19	Peppermint-like, sharp	Inh, Ing, Con	Irrit eyes, nose, throat; narco; derm
2-Methylnaphthalene	-	-	-	-

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Base/Neutral Fraction (Continued)				
Naphthalene	0.038	Tarry, creosote, mothballs	Inh, Abs, Ing, Con	Eye irrit; head; conf, excitement, mal; nau, vomit, abdom pain; irrit bladder; profuse sweat; jaun; hema, hemog, renal shutdown; derm
2-Nitroanaline (meta)	-	Slightly ammonia-like	Inh, Abs, Ing, Con	Cyan, ataxia; tacar, tachypnea; dysp; irrity; vomit, diarr; convuls; resp arrest; anemia; methemoglobinemia
3-Nitroanaline (ortho)	-	Slightly ammonia-like	Inh, Abs, Ing, Con	Cyan, ataxia; tacar, tachypnea; dysp; irrity; vomit, diarr; convuls; resp arrest; anemia; methemoglobinemia
4-Nitroanaline (para)	-	Slightly ammonia-like	Inh, Abs, Ing, Con	Cyan, ataxia; tacar, tachypnea; dysp; irrity; vomit, diarr; convuls; resp arrest; anemia; methemoglobinemia
Nitrobenzene	0.37	Pungent, paste shoe polish-like, almond-like	Inh, Abs, Ing, Con	Anoxia; irrit eyes; derm; anemia; in animals: liver, kidney damage
N-Nitrosodiphenylamine	-	-	-	May be carcinogenic
N-Nitroso-dipropylamine	-	-	-	-
Phenanthrene	-	-	-	Mod toxic by ing; skin photosensitizer; [carc]
Pyrene	-	-	Inh, Abs, Ing, Con	A carcinogenic agent
1,2,4-Trichlorobenzene	-	Pleasant, aromatic, camphor-like	Inh, Ing	Toxic
Pesticides/Herbicides				
Alachlor (Lasso)	-	-	Inh, Abs, Ing, Con	Skin, eye, nose and throat irrit; head, dizz, drow, inco, nau, unconsciousness

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Pesticides/Herbicides (Continued)				
Atrazine (Aatrex)	NA	Odorless	Inh, Abs, Ing, Con	Skin, eye irrit; loss of consciousness
Bivert PH	-	Mineral spirit-like	Inh	Narcotic; possible carc
Chlorpyrifos (Dursban)	-	-	Inh, Abs, Ing, Con	Paresthesia, musc weak, coma.
Cyanazine (Bladex)	-	-	Inh, Abs, Ing, Con	Lethargy, CNS depres, irrit skin, nau
2,4-DP (Visko-Rhap)	-	-	Inh, Abs, Ing, Con	Eye, skin irrit; resp; dizz, weak, fatigue, nau, head, uncon; asphyx; GI irrit, vomit, diarr; chemical pneu
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	NA	Odorless	Inh, Abs, Ing, Con	Weak, stupor hyporeflexia, musc twitch; convuls; derm; in animals: liver and kidney damage
EPTC (Eptam)	-	-	Inh, Abs, Ing, Con	Skin irrit
Glyphosphate (Roundup)	-	Odorless to slight amine-like	Inh, Con	Irrit mouth; nau, vomit, diarr; hypotension; lung edema
Imazapyr (Arsenal)	-	Slight ammonia-like	Inh, Abs, Ing, Con	Skin, eye irrit; narcotic
Metolachlor (Dual)	-	Faint ester-like	Inh, Abs, Ing, Con	Skin, eye, nose and throat irrit; head, nau, vomit, abdom distress; diarr, derm
Metribuzin (Sencor)	-	-	Inh, Abs, Ing, Con	Dizz, drow, breath difficulty
Picloram (Tordon)	-	-	Inh, Ing, Con	Possible carc and mutagen
2,4,5-Trichlorophenoxy Acetic Acid (2,4,5-T)	NA	Odorless	Inh, Ing, Con	In animals: ataxia; skin irrit, acne-like rash

ODOR AND EXPOSURE CHARACTERISTICS WORKSHEET

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Pesticides/Herbicides (Continued)				
Trifluralin (Treflan)	-	-	Inh, Ing	Irrit muc memb; derm, rash; nau, vomit, diarr; dizz; CNS

a Route of exposure key: Inh = Inhalation; Ing = Ingestion; Con = Skin and/or Eye Contact; Abs = Skin Absorption.

b Symptoms of exposure abbreviations key is presented in Table 2-3.

- Indicates no information available.
NA = Not applicable.
ppm = Parts per million.

Reference and Sources of Information:

1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Limits Agents.
The Condensed Chemical Dictionary 10th Ed., 1981.
NIOSH Pocket Guide to Chemical Hazards.
Personnel Protection and Safety, EPA Course 165.2 (manual).
Photovac Incorporated Technical Bulletin No. 11.
Sax's Dangerous Properties of Industrial Materials, 8th Ed.

TABLE 2-3

ABBREVIATIONS FOR SYMPTOMS OF EXPOSURE

Abbreviation	Symptom	Abbreviation	Symptom	Abbreviation	Symptom
abdom	abdominal	constip	constipation	fasc	fasiculation
album	albuminuria	constric	constriction	FEV	forced expiratory volume
anem	anemia	convuls	convulsions	fib	fibrosis
anes	anesthesia	cor	acute right heart strain or	fibrl	fibrillation
anor	anorexia		chronic right ventricular	frost	frostbite
anos	anosmia		pulmonale, hypertrophy	ftg	fatigue
ANS	automatic nervous system	corn	cornea	func	function
apat	apathy	CVS	cardiovascular system	fvr	fever
appre	apprehension	cyan	cyanosis	gasp	gasping
arrhy	arrhythmias	defat	defatting	GI	gastrointestinal
asphy	asphyxia	deg	degeneration	gidd	giddiness
asth	asthma	dent	dental	glau	glaucoma
atax	ataxia	depres	depressant/depression	glu	glucose
biliru	bilirubinuria	derm	dermatitis	halu	hallucinations
blur	blurred	diarr	diarrhea	head	headache
BP	blood pressure	dil	dilated	hema	hematuria
breath	breathing	dist	disturbance	hemat	hematoma
bron	bronchitis	dizz	dizziness	hemato	hematopoietic
broncopneu	bronchopneumonia	drow	drowsiness	hemog	hemoglobinuria
bronspas	bronchospasm	dys	dysuria	hemorr	hemorrhage
BUN	blood urea nitrogen	dysart	dysarthria	hep	hepatic
ca	cancer	dysp	dyspnea	hyper	hyperemia
cachexia	severe generalized	ecz	eczema	hypox	hypoxemia
	weakness, emaciation	emphy	emphysema	ict	icterus
[carc]	carcinogenic/carcinogen	enl	enlargement	inco	incoordination
card	cardiac	eosin	eosinophilia	incr	increase(d)
cere	cerebral	epis	epistaxis	inflamm	inflammation
chol	cholinesterase	epit	epithelium	inj	injury
chor	chorea	equi	equilibrium	insom	insomnia
cirr	cirrhosis	ery chol	erhthrocyte cholinesterase	intox	intoxication
CNS	central nervous system	eryt	erythema	irreg	irregular
coll	collapse	euph	euphoria	irrit	irritation
conf	confusion	extrem	extremities	irrity	irritability
conj	conjunctivitis	fail	failure	jaun	jaundice

TABLE 2-3 (CONTINUED)

ABBREVIATIONS FOR SYMPTOMS OF EXPOSURE

Abbreviation	Symptom	Abbreviation	Symptom	Abbreviation	Symptom
kera	keratitis	palp	palpitations	retster	retrosternal
kid	kidney	para	paralysis	rhin	rhinorrhea
lab	labored	pares	paresthesia	salv	salivation
lac	lacrimation	paresis	incomplete loss of muscular	scotoma	an area of absent or depressed
lar	laryngeal		power; weakness of a limb		vision in the visual field
lass	lassitude	parox	paroxysmal	sens	sensitization
leucyt	leukocytosis	perf	perforation	sez	seizure
leuk	leukemia	peri neur	peripheral neuropathy	sleep	sleepiness
leupen	leukopenia	perineurit	peripheral neuritis	sneez	sneezing
li-head	lightheadedness	periorb	periorbital	som	somnolence
liv	liver	phar	pharyngeal	spas	spasm
lo-ap	appetite loss	photo	photophobia	strabismus	abnormality of the eyes in which the visual axes do not meet at the desired point
low-wgt	weight loss	pig	pigmentation		
lymp	lymphocytosis	plas	plasma		
mal	malaise	pleur	pleurisy	subs	substernal
malnut	malnutrition	pneu	pneumonia	sweat	sweating
monocy	monocytosis	pneuitis	pneumonitis	swell	swelling
muc memb	mucous membrane	PNS	peripheral nervous system	sys	system
musc	muscle	polyneur	polyneuropathy	tacar	tachycardia
myo	myotonia	pros	prostration	tend	tenderness
narc	narcotic	prot	proteinuria	trachbronc	tracheobronchitis
narco	narcosis	psypec	psychialopecia	vasconst	vasoconstriction
nas	nose/nasal	pulm	pulmonary	venfib	ventricular fibrillation
nau	nausea	pulsus altenans	a pulse pattern in which beats occur at regular intervals, but with alternating weak and strong beats	verti	vertigo
nec	necrosis			vesic	vesiculation
neph	nephritis			vis dist	visual disturbance
ner	nervousness			vomit	vomiting
neur	neurologic	pup	pupil	weak	weakness
numb	numbness	RBC	red blood cell	wheez	wheezing
opac	opacity	resp	respiratory		
pal	pallor	respar	respiratory arrest		

Reference: U.S. Department of Health and Human Services, June 1990. NIOSH Pocket Guide to Chemical Hazards, Department of Health and Human Services (National Institute for Occupational Safety and Health), Publication No. 90-117.

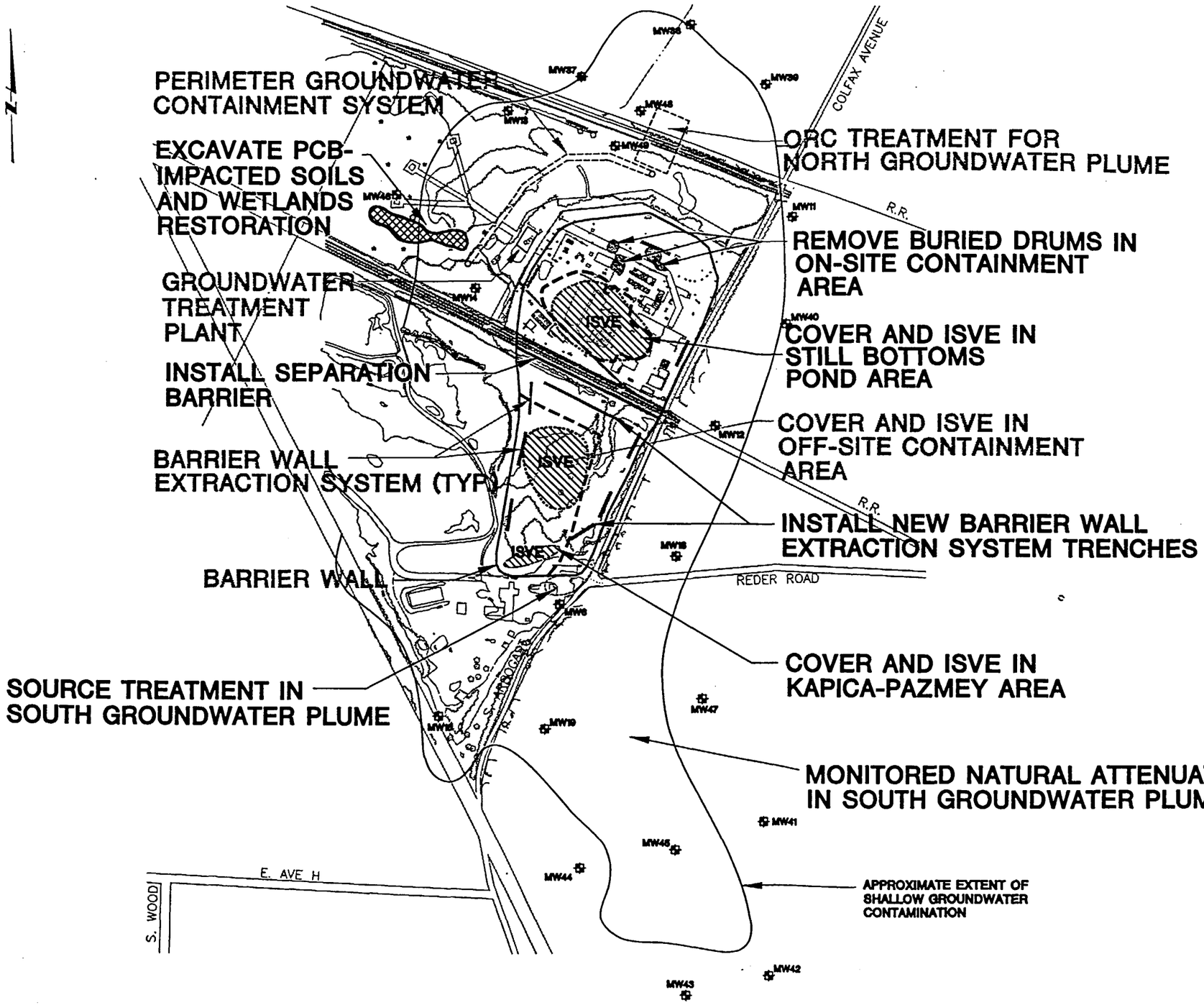
TABLE 7-1
ATMOSPHERIC AIR MONITORING DURING CONSTRUCTION ACTIVITIES
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

Area	Compound of Concern	Direct Monitoring Method	ACTION LEVEL – Upgrade to Level C	ACTION LEVEL – Upgrade to Level C Full Face	Industrial Hygiene Monitoring Required?	NIOSH Method Number
Off-Site Containment Area	Benzene	Draeger Tube 8101231	Any positive	10 ppm	Yes	1501
	Chloroform	Draeger Tube 6728861	5 ppm	10 ppm	Yes	1003
	1,1-Dichloroethene	Draeger Tube 8101721	**Any positive go to LEVEL B**	--	Yes	1015
	Others (assume trichloroethene)	PID	10 ppm	100 ppm	No	NA
On-Site Containment Area	Benzene	Draeger Tube 8101231	Any positive	10 ppm	Yes	1501
	Others (assume tetrachloroethylene)	PID	5 ppm	50 ppm	No	NA
Still Bottoms Pond Area	Carbon Tetrachloride	Draeger Tube 8101021	Any positive	10 ppm	Yes	1003
	Chloroform	Draeger Tube 6728861	5 ppm	10 ppm	Yes	1003
	Others (assume methylene chloride)	PID	10 ppm	100 ppm	No	NA

NOTES:

1. **Initial level of protection for work in all areas is Level B.** After health hazard assessment database has been developed, can downgrade to Level C or D as appropriate. Be aware that different tasks and areas will have different exposure potential – downgrade after you have task-specific exposure data.
2. Respirator cartridges should be changed at least every half-hour (based on chloroform break through time). If chloroform can be ruled out, 45 minutes can pass before changing cartridges.
3. PID = Photoionization Detector

KAW/jms/TAB
\\CHI1_SERVER\JOBS\1252\042\28\Documents\125204228a123.doc
1252042.281201



LEGEND

- BARRIER WALL
- PERIMETER GROUND WATER CONTAINMENT SYSTEM
- AREA TO BE TREATED WITH ISVE
- CAP BOUNDARY
- MW41 MONITORING WELL

NOTE:
REMEDIAL ACTIONS PROPOSED ARE BOLD TYPE FACE. EXISTING MEASURES ARE SCREENED TYPE FACE.

Job No. MW Job # File J:/1252/042/drawings/civ/acs28c11.dwg Plot Date: 8888date8888

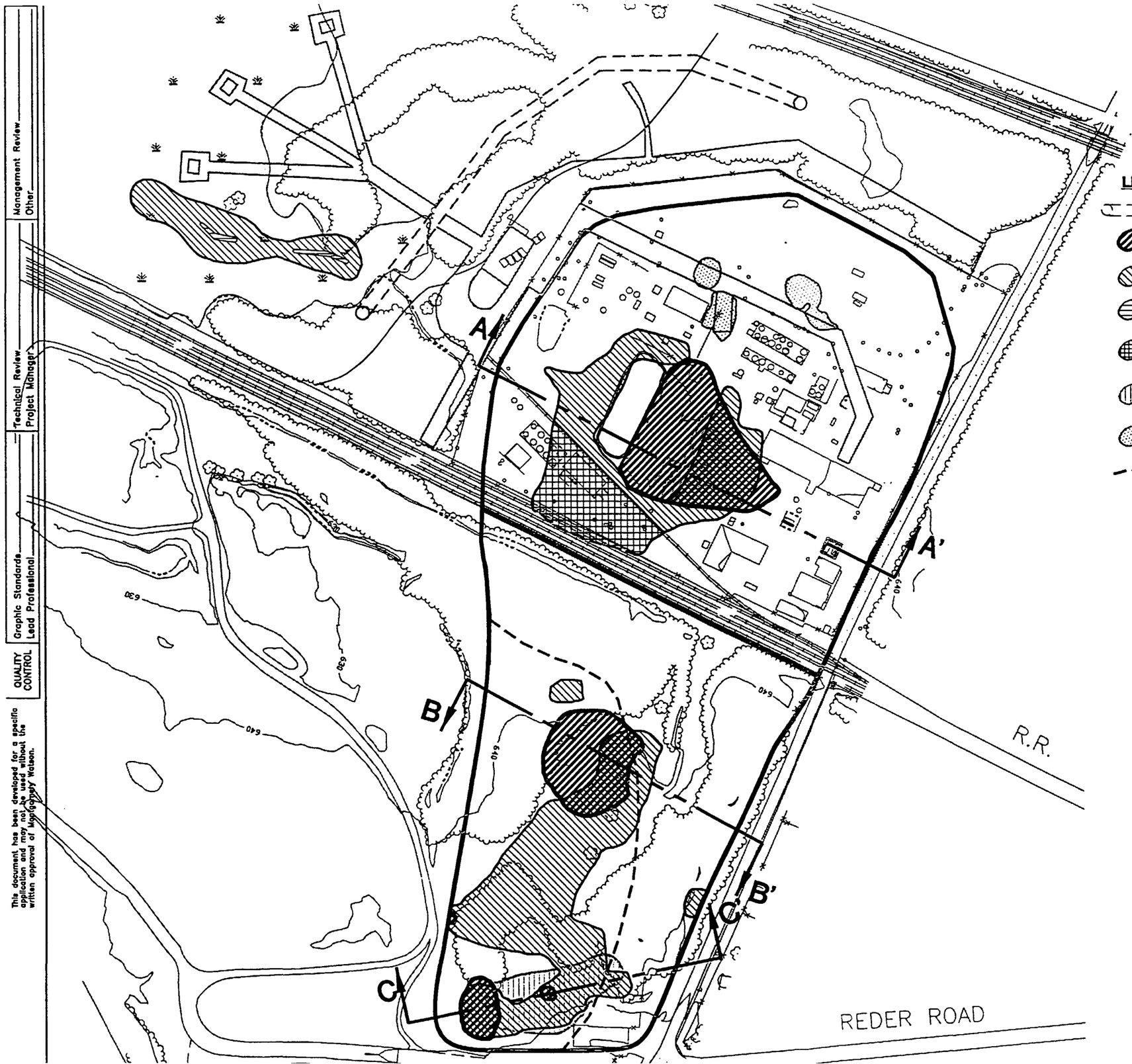
SCALE 1" = 250'-0"	WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED TAB DRAWN RBA CHECKED TAB	SUBMITTED BY TOM BLAIR (PROJECT MANAGER)	IN-19600482 LICENSE NO.	DATE	MONTGOMERY WATSON Chicago, Illinois	ACS RD/RA GROUP AMERICAN CHEMICAL SERVICE SUPERFUND SITE GRIFFITH, INDIANA

REV	DATE	BY	DESCRIPTION

95% REMEDIAL DESIGN

OVERALL REMEDIAL ACTIONS PLAN

SHEET 1



LEGEND

- PERIMETER GROUND WATER CONTAINMENT SYSTEM
- AREAS WITH TOTAL VOCs > 10,000ppm
- AREAS WITH TOTAL PCBs > 10ppm
- AREAS WITH TOTAL PCBs > 50ppm
- AREAS WITH TOTAL PCBs > 10ppm > 8FT BELOW GROUND SURFACE
- AREAS WITH LEAD > 500 ppm
- AREAS OF BURIED DRUMS – AS DEFINED BY GEOPHYSICAL SURVEYS
- APPROXIMATE EXTENT OF SITE CONTIGUOUS WITH CITY OF GRIFFITH LANDFILL

north

0 200 400

SCALE IN FEET

FIGURE 2

Management Review
Other
Technical Review
Project Manager
Graphic Standards
Lead Professional
QUALITY CONTROL

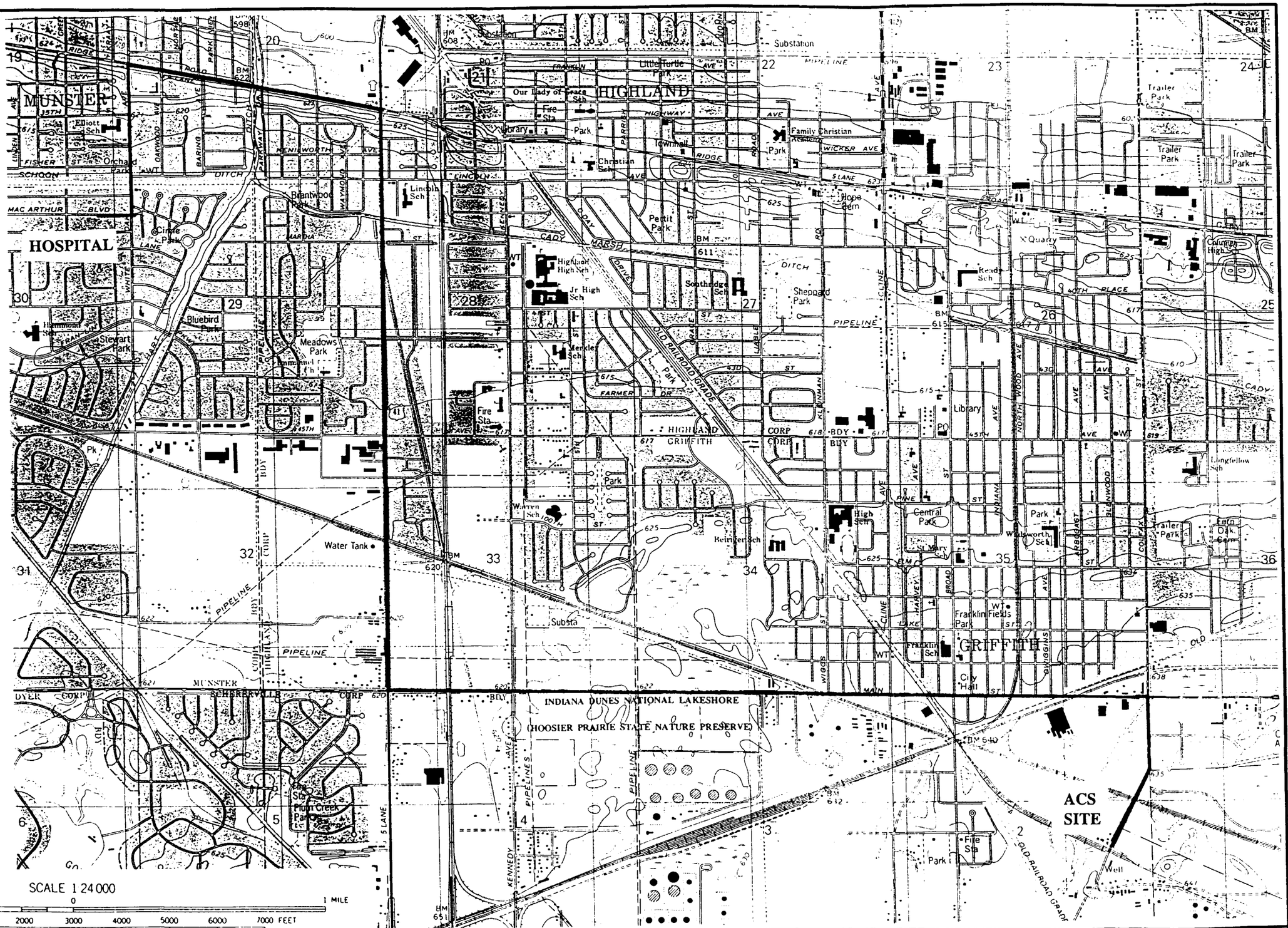
Developed By TLH
Drawn By DKP
Approved By TAB
Date 1/28/99
Reference J:\1252\042\28\DRAWINGS\AS1.dwg
Revisions

AREAS OF SOILS IMPACT

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

Drawing Number
1252042
260101 2

MONTGOMERY WATSON



SCALE			FIGURE
1:24,000	MONTGOMERY WATSON Chicago, Illinois	AMERICAN CHEMICAL SERVICE, INC. GRIFFITH, INDIANA	SITE LOCATION MAP AND HOSPITAL ROUTE 4-1

Plot Date: 00000date00000 File: J:\1252\042\28\gen\cmap1042.dgn Job No: MW Job #

A

SUBJECT: PERMIT REQUIRED CONFINED SPACES

I. PURPOSE

To set forth minimum requirements and procedures for the safety and health of Montgomery Watson employees who work in and about confined spaces.

II. REFERENCES

A. Federal Occupational Safety and Health Agency (OSHA) Standard: Title 29, Code of Federal Regulations, Part 1910.146 "Permit Required Confined Spaces" 1993.

B. Corresponding requirements from various State-administered OSHA programs.

C. American National Standards Institute, ANSIZ117.1-1977.

D. National Institute for Occupational Safety and Health (NIOSH) Criteria Document, "Working in Confined Spaces," December 1979.

E. NIOSH Alert, "Request for Assistance in Preventing Occupational Fatalities in Confined Spaces," January 1986.

III. ATTACHMENTS

A. Entry Permit, "Inspection and Testing for Confined Space Entry"

B. Area Danger Sign

C. Simplified Permit (Ventilation Control)

D. Sewer Entry Procedure

E. Tank Entry Procedure

IV. DISCUSSION

Confined spaces are normally considered to be enclosures having limited means for personnel entry and exit, by reason of location, size or number of openings; and, unfavorable natural ventilation which could contain or produce dangerous air contaminants, flammable or explosive atmospheres, and/or oxygen deficiency.

Confined spaces include, but are not limited to, storage tanks, process or reaction vessels, boilers, pits, silos, vats, degreasers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, trenches, excavations, pumping/lift stations and pipelines.

The multiple hazards associated with entrance and work in confined spaces are capable of causing bodily injury, illness, or death to Montgomery Watson employees. Confined spaces can become unsafe as a result of: (1) possible atmospheric contamination by toxic or flammable vapors; (2) oxygen deficiency (i.e. less than 19.5%); (3) the possibility of liquids, gases, vapors or solids being admitted during occupancy; or (4) physical isolation and engulfment of employees in need of rescue.

This procedure prescribes minimum requirements for safe entry, continued work in, and exit from confined spaces. Additionally, it describes the steps necessary to protect Montgomery Watson personnel from exposure to dangerous air contaminants, explosive atmospheres, and/or oxygen deficiency.

V. DEFINITIONS

A. **Atmosphere** - Gases, vapors, mists, fumes and dusts present within the confined space.

B. **Attendant** - A standby employee who is stationed nearby to the confined space operation. The attendant is familiar with confined space procedures, in recognizing signs of fatigue or overexposures, is in frequent communication with entrants, insures the security of the work site, is authorized to terminate any operations, and is prepared to summon rescue & emergency services.

C. **Authorized Entrants** - An employee who has received special training in confined space procedures, specialized equipment, hazard recognition, and is authorized by the company to enter a permit space.

D. **Confined Space** - A space that

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; AND

2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); AND

3. Is not designed for continuous employee occupancy.

E. **Hazardous Atmosphere** - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability of self-rescue, injury, or acute illness. This would include:

1. The presence of a flammable gas, vapor, or mist in excess of 10% of the lower explosive level (LEL).

2. Airborne combustible dust at a concentration that exceeds its LEL. (Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.)

3. Any oxygen concentration below 19.5% or above 23.5%.

4. Any atmospheric condition recognized as immediately dangerous to life and health (IDLH).

5. An atmospheric concentration of any substance above its permissible exposure limit (PEL).

F. **Entry** - Passing through an opening into a permit-required confined space. Entry is considered to have occurred as soon as **any part** of the entrant's body **breaks the plane** of an opening into the space.

G. **Entry Supervisor** - The employee assigned the overall responsibility for the safe confined space operation. The entry supervisor must be familiar with the operation and its hazards, must insure that all appropriate tests have been conducted before endorsing the entry form, verify availability of rescue services, control access to the space during operations, and insure continued operational compliance during any transfer of responsibilities/personnel.

H. **Hot Work** - Any work involving burning, welding, or similar fire producing operations, as well as work that produces a source of ignition such as drilling, abrasive blasting and space heating.

I. **IDLH** - Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

J. **Inerting** - Displacement of the atmosphere by a nonreactive gas (such as nitrogen or carbon dioxide) so that the resultant atmosphere is noncombustible. (Note: This procedure produces an IDLH oxygen-deficient atmosphere.)

K. **LEL** - Minimum concentration of a combustible gas, vapor, or mist in air that will ignite if an ignition source is present.

L. **Material Safety Data Sheet (MSDS)** - A document prepared by the manufacturer or importer of a chemical material which lists its fire, physical and health hazards, as well as, recommended workplace controls and personal protective equipment.

M. **Non-Permit Confined Space** - A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

N. **Oxygen Deficiency** - An atmosphere containing less than 19.5 percent oxygen by volume. Normal air contains approximately 21% oxygen. For the purpose of this procedure, any atmosphere containing less than 19.5% oxygen by volume shall be considered oxygen deficient and IDLH.

O. **PEL** - The maximum time weighted average concentration of a substance to which an employee can be exposed 8 hours a day, 5 days a week for a working lifetime, without harmful effects. PELs are established by OSHA.

P. **Permit-Required Confined Space** - A confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;

2. Contains a material that has the potential for engulfing an entrant;

3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

4. Contains any other recognized serious safety or health hazard.

Q. **Purging** - Method by which gases, vapors, or other airborne contaminants are displaced from a confined space.

VI. PROCEDURE

A. The **entry supervisor** shall evaluate the workplace for "confined spaces."

1. The **permit-required confined spaces (PRCSs)** shall be identified.

2. All **PRCSs** shall be identified with a sign reading: **DANGER--Permit-Required Confined Space, Do Not Enter** (Attachment B), or any other method, such as training, or a site identification map.

B. If entry is required into a PRCS, the entry supervisor must insure that the following requirements are met:

1. **Written** procedure for safe entry must be established. (Refer to Attachment D "Sewer Entry Procedure" and Attachment E "Tank Entry Procedure" for two typical entries at Montgomery Watson.)

2. **All equipment** referenced in the appropriate written procedures must be provided.

3. Perform the **air testing and monitoring**.

4. Provide at least **one attendant** (or as many as needed to adequately cover multiple entry operations).

5. Designate in writing the **names** of the **authorized entrants, attendants**, and **entry supervisors**.

6. Establish a plan for providing **rescue and emergency services**.

7. Establish an **expiration time/date** for the PRCS operation.

8. Complete and issue the **Entry Permit**, and maintain a copy for future reference.

9. Conduct an **annual review** of the PRCS program, using past completed Entry Permits. Maintain a written record of this.

C. A **simplified entry** may be employed provided that the entry supervisor determines that the following two conditions are met:

1. Identified **hazards** are exclusively **atmospheric** (for example, no direct contact hazards with corrosive liquids, no radiation, mechanical or electrical hazards); AND

2. The atmospheric hazards (actual or potential) can be eliminated by **continuous forced air ventilation**, as measured from **outside** the PRCS.

D. The **simplified entries** into a PRCS noted in "C" above involve the following steps (which require verification from the entry supervisor):

1. Completion of employee training.

2. Removal of entry cover safely, e.g., watch for pressure and explosive potential.

3. **Guard opening** created by removal of the cover promptly.

4. **Test** space for **oxygen content, LEL**, and **toxic air contaminants** to **PEL levels**.

5. Provide continuous **forced air ventilation** insuring a non-hazardous atmosphere.

6. **Retest periodically** for oxygen content, LEL, and toxic air contaminants.

7. When a hazard is detected:

   a. Leave the confined space.

b. Reevaluate the site.

c. Correct any deficiencies.

8. **Maintain written documentation** of the entry (See Attachment C, "Simplified Permit") and include:

a. Date

b. Location

c. Signature

E. If any entry will be made into a PRCS by a **contractor employee**, a **visitor, official**, or **any regulatory personnel**, the entry supervisor **must notify** that person of the procedures, hazards, and general precautions of the entry.

F. Employee Training

1. Employees assigned to work in or about PRCSs shall have documented training proficiency that includes:

a. Chemical and physical hazards

b. Safe work practices and techniques

c. Testing requirements/Instrumentation

d. Safety Equipment, including:

(1) Respiratory protection

(2) Protective clothing

(3) Lifelines, harnesses, extraction devices, etc.

e. Emergency first aid and rescue procedures

f. Applicable Federal, state and local regulations

g. This Permit Required Confined Space Procedure

2. A written record will be maintained of the employee's training, including the name of the trainer.

G. Personal Protective Devices

1. Respirators may be required by the entry supervisor to provide protection against varying concentration levels of toxic air contaminants.

   a. All users must be trained as regards the use/limitations of the specific respirator, and be medically qualified as noted in Bulletin VIII-2 ("Respiratory Protection Equipment"), H&S Manual.

   b. All respirators have use limitations; use of the wrong respirator can result in serious injury or death.

2. Hand & Body Protection may be required by the entry supervisor if the PRCS contains any potential chemical, mechanical, or abrasive hazards.

   a. Protective gloves and coveralls must provide chemical resistance from hazardous materials. Refer to Bulletin VIII-5 ("Hand & Body Protection"), H&S Manual.

   b. Secondary exposures to chemicals can occur by use of improperly rated materials, i.e., chemical permeation through glove material.

3. Fall Protection is required during **ALL** PRCS operations as part of the Non-Entry Rescue Requirements. (Refer to next section, H.4.)

   a. Full-body harness must meet the Class III requirements of OSHA 1926.104 and ANSI A10.14.

   b. Nylon lifeline at least 1/2" in diameter and a minimum breaking strength of 2,650 pounds.

   c. Careful inspection of equipment before and after use is required.

4. Eye & Face Protection may be required by the entry supervisor to protect against chemical, splashing, or mechanical hazards.

   a. Protective glasses, goggles, or face shields must be used within their design limitations. See Bulletin VIII-1 ("Eye & Face Protection"), H&S Manual.

   b. The potential hazard will determine the type of protection to be worn.

H. PRCS Rescue

1. A rescue team must be designated and available for all PRCS entries. The rescue team can be either in-house employees or from an outside service.

2. If **in-house** employees,

   a. Employees must be trained and provided all protective and rescue equipment.

   b. Employees must be trained to perform all duties, and receive same training as authorized entrants.

   c. Must complete a yearly practice exercise in a simulated/actual PRCS using mannequins or actual persons.

   d. Each team member shall have received basic first aid and CPR training in the past. One of the members must be currently certified and available.

3. If **outside service,**

   a. Entry supervisor must inform rescue service of hazards they may encounter if called.

   b. Entry service must provide rescue service with access to all permit spaces for planning and practice.

4. **Non-Entry** Rescue Requirements

   Systems or methods to provide non-entry rescue must be in place **during all PRCS entries,** unless the entry supervisor determines that such systems would increase risks to entrants.

   a. Each entrant must wear a **chest or full body harness, with a lifeline attached to a "D" ring located at the center of the entrant's back or above the entrant's head.** (Wristlets may be used if the entry supervisor determines that this is the most effective alternative.)

   b. The other end of the lifeline shall be attached to a **mechanical device (such as a winch) or fixed point** outside the PRCS to begin immediate rescue.

      Mechanical devices are **required** for entry into vertical permit spaces **more than 5 feet deep.**

5. **MSDSs** or similar material must be kept at the worksite and made available to the medical facility treating any exposed entrant.

VII. SUMMARY

Entry into Permit-Required Confined Spaces entails extensive training, specific monitoring, following detailed procedures, and keeping accurate records. This is reflective of the potentially serious exposure hazards, and even fatalities, that can occur during an improper entry.

Therefore, the company requires full compliance with these provisions during all entries into PRCSs. If you have any further questions, or need technical support and training, please contact the Corporate Health & Safety Office at (818)568-6678 in Pasadena.

ENTRY PERMIT

INSPECTIONS AND TESTS FOR ENTRY
INTO PERMIT REQUIRED CONFINED SPACES

Date: _____
Job Number: _____

Client Name/Address: _____
Space to be Entered: _____
Identified Hazards: _____
Authorized Entrants (By Name): _____
Attendants (By Name): _____
Rescue & Emergency Services Provided By: _____
Telephone: _____

PERMIT EXPIRATION

This permit EXPIRES: Time/Date: _____

MONITORING DATA

(Monitor in this order: Oxygen, LEL, Toxicity)

TIME	% OXYGEN (19.5% to 23.5%)	% LEL (<10%)	TOXICITY e.g., hydrogen sulfide 10 ppm; carbon monoxide 35 ppm. (Others in PEL Tables.)

Instrumentation (Serial No./Calibration Date): _____

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE
_____ Chemical Goggles
_____ Face Shield
_____ Safety Glasses

EXTREMITIES
_____ Hard Hat
_____ Gloves (TYPE: _____)
_____ Rubber Boots
_____ Safety Shoes

BODY

_____ Cotton Coveralls
_____ Tyvek® Suite
_____ Coated Tyvek® Suit
_____ Other (_____)

RESPIRATORY

_____ SCBA
_____ Airline (Supplied Air)
_____ Air Supplied w/Egress
_____ Air Purifying, Model: _____
Cartridge Type: _____
_____ Disposable (Brand/Type: _____)

OTHER

_____ Hearing Protection
_____ Full Body Harness w/"D" ring and Lifeline

EMERGENCY EQUIPMENT

_____ Fire Extinguisher. Type: _____ Location: _____
_____ Emergency Eyewash/Shower Facility. Location: _____
_____ Emergency Telephone. Location: _____
_____ Fire/Emergency Alarm. Location: _____

CHECKLIST

	YES	N/A
All lines leading to and from permit required confined space have been blinded or disconnected.	_____	_____
Electrical service disconnected or locked out.	_____	_____
Grounding and bonding wire in place.	_____	_____
Breathing supply and alarms checked and are in proper condition.	_____	_____
The complete respiratory supply system has been checked and is in proper condition.	_____	_____
All safety harnesses and life lines checked and in proper condition. (Mechanical hoisting device required for vertical entries greater than 5 feet deep.)	_____	_____
Required protective clothing (gloves, boots, etc.) being used.	_____	_____
Employees have been trained in the use, care, and limitations of their respiratory protective equipment.	_____	_____
Outside attendant trained in emergency procedures.	_____	_____

All emergency systems such as air packs, fire extinguishers, backup breathing supply, alarms, etc., ready for use. _____ _____

Danger sign posted. _____ _____

Ventilation equipment in use. _____ _____

All electrical equipment listed Class 1, Division 1, Group D and non-sparking tools. _____ _____

SPECIAL INSTRUCTIONS

_____

_____

_____

Completed By: _____ Signature: _____
(Print Name) Date: _____

Entry Supervisor Approval: _____ _____
(If different than above.) (Print Name) (Date)

_____
(Signature)

SIMPLIFIED PERMIT
FOR
PERMIT REQUIRED CONFINED SPACES

Date: _____
Job Number: _____

Client Name/Site Address: _____
Space to be Entered: _____
Identified Hazards: _____

MONITORING DATA
(Monitor in this order: Oxygen, LEL, Toxicity)

TIME	% OXYGEN (19.5% to 23.5%)	% LEL (<10%)	TOXICITY e.g., hydrogen sulfide 10 ppm; carbon monoxide 35 ppm. (Others in PEL Tables.)

PERSONAL PROTECTIVE EQUIPMENT

List: _____

CHECKLIST

	YES	N/A
Safe to remove cover.		
Opening guarded.		
Space tested for oxygen, LEL, and toxic contaminants.		
Provide continuous forced air ventilation.		
Retest after ventilation, but prior to entry. (Periodically, as appropriate.)		

HAZARD DETECTION

If a hazard is detected: Leave the confined space. Reevaluate the site. Correct any deficiencies.

APPROVAL

Completed By: _____ Signature: _____
(Print Name) Date: _____

Entry Supervisor Approval: _____ _____
(If different than above.) (Print Name) (Date)

_____
(Signature)

SEWER ENTRY PROCEDURE

I. GENERAL DISCUSSION

Sewer entry differs in two vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer.

A. *Adherence to procedure.*

Montgomery Watson designates as entrants only employees who are thoroughly trained in these sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

B. *Atmospheric monitoring.*

Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions is encountered: oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower explosive limit (LEL); or hydrogen sulfide or carbon monoxide at or above their PEL (10 ppm or 35 ppm, respectively); or, if a broad range sensor device is used, at 100 ppm as characterized by its response to its hydrocarbon calibration source. While the oxygen sensor/broad range sensor instrument can be used for sewer entry, substance specific devices should be used whenever actual contaminants have been identified. The instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrants' direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

C. *Entry Coordination.*

Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.

D. *Special Equipment.*

Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBA) with 5 to 10 minutes air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

II. POTENTIAL HAZARDS

The employees could be exposed to the following:

A. *Engulfment.*

B. *Presence of toxic gases.*

Equal to or more than 10 ppm hydrogen sulfide. If the presence of other toxic contaminants is suspected, specific monitoring to its PEL will be conducted.

C. *Presence of explosive/flammable gases.*

Equal to or greater than 10% of the lower explosive limit (LEL).

D. *Oxygen Deficiency.*

A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

III. SIMPLIFIED ENTRY REQUIREMENTS

A permit required confined space may be entered without the need for completing an entry permit (Attachment A) or assigning an attendant, if: 1) the space is determined *not* to be a permit required confined space, or 2) the space can be maintained in a safe condition for entry by mechanical ventilation alone. All spaces shall be considered permit-required confined spaces until a pre-entry evaluation demonstrates otherwise.

A Simplified Permit (Attachment C) must be completed by the entry supervisor before entry into these spaces. This simplified permit verifies completion of minimum safety guidelines. If problems are encountered, however, the entrants must be removed, and the permit space re-evaluated.

A. *Pumps and Lines.*

All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination

of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space, the provisions for entry into a permit-required confined space must be implemented.

B. *Surveillance.*

The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

C. *Testing.*

The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. An alarm only type gas monitor may be used. Testing shall be performed by the entry supervisor who has successfully completed training for the monitor he/she will use. The minimum parameters to be monitored are oxygen deficiency, LEL, and hydrogen sulfide concentration. The test results shall be recorded on the Simplified Permit and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

D. *Entry Procedures.*

If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. **Continuous** testing of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. Forced air ventilation into the confined space shall be provided at all times during the entry operation. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until the entry supervisor, who has completed the gas detector training, has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

E. *Rescue.*

Arrangements for rescue services are not required for entry into simplified permit spaces.

IV. ENTRY PERMIT REQUIREMENTS

A. *Permits.*

Confined Space Entry Permit. All spaces shall be considered permit-required confined spaces until the pre-entry evaluation demonstrates otherwise. Any

employee required or permitted to pre-check or enter a permit-required confined space shall have successfully completed, at a minimum, the training as required by the following sections of these procedures.

A written copy of this procedure, including specific rescue information as required by these procedures shall be at the work site for the duration of the job. The Confined Space Entry Permit (Attachment A) must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job.

If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, the employees must be removed immediately from the space, and a new Confined Space Entry Permit must be completed.

B. *Surveillance.*

The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping, or sewers.

C. *Testing.*

The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the entry supervisor who has successfully completed the training for the monitoring equipment he/she will use.

The minimum parameters to be monitored are oxygen deficiency, LEL, and hydrogen sulfide concentration. The test results shall be recorded on the Entry Permit, and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

D. *Space Ventilation.*

Mechanical ventilation systems, where applicable, shall be set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing.

Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

E. *Entry Procedures.*

The following procedure shall be observed under any of the following conditions:

-- Testing demonstrated the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;

-- The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;

-- It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or

-- An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

1. All personnel must be trained.

2. A self contained breathing apparatus shall be worn by any person entering the space.

3. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency.

4. The standby worker shall have a self contained breathing apparatus available for immediate use.

5. There shall be a least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within the confined space and standby personnel.

6. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life.

   Local fire department rescue personnel shall be notified immediately.

7. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus), if previously trained and qualified, and only after being relieved by another worker.

   Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening.

The standby worker shall attempt to first remove a disabled worker via his lifeline before entering the space.

8. When practical, these spaces shall be entered through side openings--those within 3 1/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the space.

9. In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued, if approved by the entry supervisor.

10. When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per National Electrical Code and no ignition sources shall be introduced into the area.

11. Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

F. *Rescue.*

1. Call the fire department services for rescue.

2. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

TANK ENTRY PROCEDURE

I. GENERAL DISCUSSION

Workplaces where tank cars, trucks, and trailers, chemical storage tanks, dry bulk tanks and trailers, railroad tank cars and similar tanks are installed, inspected or serviced pose potential confined spaces hazards to employees.

A. Adherence to procedure

Montgomery Watson designates as entrants only employees who are thoroughly trained in these tank entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing tank entries.

B. Atmospheric monitoring

Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions is encountered: oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower explosive limit (LEL); toxic air contaminant at or above its PEL; or, if a broad range sensor is used, at 100 ppm as characterized by its response to its hydrocarbon calibration source.

While the oxygen sensor/broad range sensor can be used for tank entry, substance specific devices should be used whenever actual contaminants have been identified. Monitoring should be repeated periodically as directed by the entry supervisor.

C. Sources of Hazards

<u>New Tanks/Installations</u>

In addition to the mechanical hazards arising from the risks that an entrant would be injured due to contact with components of the tank or the tools being used, there is also the risk that a worker could be injured by breathing fumes from welding materials or mists or vapors from materials used to coat or clean the tank interior. In addition, many of these vapors and mists are flammable, so the failure to properly ventilate a tank could lead to a fire or explosion.

<u>Servicing/Inspection, Existing Tanks</u>

Tanks which have been in service may contain residues of dangerous materials, whether left over from previous cargoes or generated by chemical or bacterial action on residues of non-hazardous cargoes.

D. Control of Hazards

1. Welding: Local exhaust ventilation shall be used to remove welding fumes once the tank or carrier is completed to the point that workers may enter and exit only through a manhole. (Follow the requirements of 29 CFR 1910, Subpart Q, OSHA's welding standard, at all times.) Welding gas tanks may never be brought into a tank or carrier that is a permit entry confined space.

   Surface materials shall be removed 4 inches or more from any surface area where welding or any torch work will be done and care taken that the atmosphere within the tank remains well below the LEL.

2. Application of interior coatings/linings: Atmospheric hazards shall be controlled by forced air ventilation sufficient to keep the atmospheric concentration of flammable materials below 10% of the lower explosive limit (LEL). The appropriate respirators are provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

II. SIMPLIFIED ENTRY REQUIREMENTS

A permit required confined space may be entered without the need for completing an Entry Permit (Attachment A), or to have an attendant assigned, if: 1) the space is determined not to be a permit required confined space, or 2) the space can be maintained in a safe condition for entry by mechanical ventilation alone. All spaces shall be considered permit required confined spaces until a pre-entry evaluation demonstrates otherwise.

A. A Simplified Permit (Attachment C) must be completed by the entry supervisor before entry into these spaces. This Simplified Permit verifies completion of minimum safety guidelines. If problems are encountered, however, the entrants must be removed, and the space evaluated.

   1. All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contaminants or engulfment. If blocking and/or isolation requires entry into the space, the provisions listed in the Entry Permit (Attachment A) must be followed.

   2. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen concentration problems exist. Testing shall be performed by the entry supervisor who has successfully competed training for the monitor used. The minimum checks will be for oxygen deficiency/enrichment, LEL, and toxic gases. The test results shall be recorded on the Simplified Permit and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

3. If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen concentration problems within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Periodic testing, as determined by the entry supervisor, will be completed.

   Forced air ventilation into the confined space shall be provided at all times during the entry operation. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until the entry supervisor determines it is safe to do so.

4. Arrangements for rescue services are not required for entry into simplified permit spaces.

III. ENTRY PERMIT REQUIREMENTS

A. Permits.

The entry supervisor must insure that an Entry Permit (Attachment A) is completed if the space has been classified as a permit required confined space, and cannot be entered using a Simplified Permit (Attachment C). If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, the employees must be removed immediately from the space, and a new Entry Permit completed.

B. Testing.

The confined space atmosphere shall be tested whether dangerous air contamination and/or oxygen concentration problems exist. A direct reading gas monitor shall be used. The test results shall be recorded on the Entry Permit, and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

C. Space Ventilation.

Mechanical ventilation systems, where applicable, shall be set at 100% outside air. After a suitable ventilating period, repeat air testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

D. Entry Procedures.

The following procedures shall be observed under any of the following conditions:

-- Testing demonstrated the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;

-- The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;

-- It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or

-- An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

1. All personnel must be trained.

2. A self contained breathing apparatus shall be worn by any person entering the space.

3. At least one worker shall stand by on the outside of the space ready to give assistance in case of emergency.

4. The standby worker shall have a self contained breathing apparatus available for immediate use.

5. There shall be at least one additional worker within sight or call of the standby worker. Continuous communications shall be maintained between the worker in the confined space and standby personnel.

6. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately.

7. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus), if previously trained and qualified, and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to first remove a disabled worker via his lifeline before entering the space.

8. When practical, these spaces shall be entered through side openings--those within 3 1/2 feet of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the place.

9. In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued, if approved by the entry supervisor. An alternate procedure must be instituted.

10. When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per national Electrical Code and no ignition sources shall be introduced into the area.

11. Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new Entry Permit issued.

E. Rescue

1. Call the fire department services for rescue.

2. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

B

ATTACHMENT B

PERSONAL ACKNOWLEDGEMENT FORM

As a component of the Site Safety Plan (SSP) designed to provide personnel safety during site activities at the American Chemical Services, Inc. site in Griffith, Indiana, you are required to read and understand the Predesign SSP and SSP Addendum. When you have fulfilled this requirement, please sign and date this "Personal Acknowledgement." Also, provide the requested information pertaining to use of Level C respiratory protection.

Model/Type of Level C Respirator: _____

Date Fit Tested: _____

_____

Signature

_____

Name (Printed)

_____

Date

C

ATTACHMENT C

TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Job Number: _____

SITE LOCATION: 420 SOUTH COLFAX AVENUE, GRIFFITH, INDIANA

Scope of Work: ISVE well installation; slurry wall installation; groundwater elevation measurements; waste excavation and gas collection system installation; excavation and relocation of waste; grading/earthwork; cover preparation and installation; and drainage structures and access road construction, drum removal, and PCB-impacted soils excavation.

SAFETY TOPICS PRESENTED

Chemical Hazards:

1. Chemicals of Concern: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), Pesticides, Polychlorinated Biphenyls (PCBs), and Metals.
2. Warning properties (Table 2-2 of SSP).
3. PPE Needed:
   - *Drilling/Excavation Activities:* Steel-toed boots, hard hats, and hearing and eye protection. While excavation activities are being conducted in the landfill waste, 4-mil nitrile inner and outer gloves and Tyvek® outer protective clothing will be worn. Respiratory protection may also be required when evidence of previously landfilled medical wastes is observed.
   - *Groundwater:* Steel-toed boots, hard hats, eye protection, 4-mil nitrile inner and 22-mil nitrile outer gloves. Protective apron may be worn subject to HSC's or HSM's approval.

Physical Hazards:

1. Equipment dangers
2. Utility lines
3. Heat/cold stress
4. Vehicle traffic hazards
5. Trip, slip, and fall hazards
6. Work limitations (temperature, weather conditions, light): Work will take place during daylight unless artificial light is provided; work may be postponed due to adverse weather conditions such as lightening or extreme hot or cold temperatures; a sufficient number of breaks will be allowed.

Monitoring:

1. Equipment needed/used: PID, Dräger pump, MINIRAM, and Exotox 50® will be used for organic vapors, benzene, chloroform, 1,1-dichloroethene, carbon tetrachloride, oxygen, hydrogen sulfide, lower explosive limits (LELs), and dust conditions.
2. Chemicals being monitored for: Total organic vapors, benzene, chloroform, 1,1-dichloroethene, carbon tetrachloride, oxygen, HCN, hydrogen sulfide, LELs, and dust.
3. Levels for ceasing operation or downgrading to Level C or D: Table 7-1 of Site Safety Plan Addendum
4. Frequency of readings and logging in field book: PID, Dräger tube, and Exotox 50® readings will be taken in the breathing zone of site workers (2 to 5 feet above the ground) during intrusive activities at 30-minute intervals, at a minimum. More frequent monitoring will be conducted if elevated readings are recorded. All readings will be logged in the field notebook.

Special Equipment: None.

Decontamination of Clothing/Equipment:

1. Cleaning solvents used: Alconox®, distilled water.
2. Disposal of clothing/equipment: In sealed plastic bags and on-site dumpsters.

Site Control:

1. Location of working zones
2. PPE needed in various zones:
   Level D, C, or B in exclusion zone
   Level D, C, or B work clothes in support zone

Other:

- No smoking, eating, or drinking in work areas.
- Containers for disposable PPE available at exit point of exclusion zone.

Emergency Procedures:

1. Location of emergency equipment: First aid kit, eye wash kit and fire extinguisher located in each field vehicle, extra safety supplies located in field vehicle.
2. Designated safety vehicle
3. Posted emergency information, route to hospital map, chemical symptoms table

ATTENDEES

NAME PRINTED	SIGNATURE

Meeting Conducted By: _____ _____

Name Printed Signature

D

ATTACHMENT D

EMERGENCY ASSISTANCE INFORMATION

American Chemical Service, Inc. NPL Site
420 South Colfax Avenue
Griffith, Indiana

Nearest Hospital	Munster Community Hospital 901 McArthur Boulevard Munster, Indiana Phone: (219) 836-1600 Exit Site onto Colfax north to Main Street. Take left onto Main, head west to Indianapolis Boulevard (Route 41). Take right onto 41 (north) to Ridge Road. Take left onto Ridge Road (west) to Calumet Avenue. Turn left onto Calumet Avenue (south). Hospital emergency entrance is on east side of street, just past Fisher Street. See Emergency Route Map supplied with SSP Addendum (Figure 4-1).
Nearest Telephone	Montgomery Watson Treatment Building
Ambulance, Fire, Police, & Sheriff	Telephone 911
State Highway Patrol	(800) 552-8917
First-Aid kit, Fire Extinguishers, & Emergency Eye Lavages	Montgomery Watson Treatment Building
Poison Control	(800) 382-9097

Project Contacts Montgomery Watson

Project Coordinator	Joseph Adams, Jr.	303-410-4040
Health & Safety Coordinator	Brian Griesemer	630-691-5060
On-Site Safety Officer	Lee Orosz	219-924-4607
Project Manager	Todd Lewis	630-691-5061

Client Contact/Regulatory Contact

U.S. EPA Remedial Project Manager	Kevin Adler	312-886-7078
IDEM Project Manager	Sean Grady	317-308-3121

Regulatory Notification

IDEM Emergency Response	(317) 233-7745
EPA Spill Response Region 5	(312) 353-2318

Utilities

Telephone
Ameritech – (800) 636-1200

Gas/Electric Company
NIPSCO – (800) 634-3524

Utility Locate
IN Underground Plant Protection Service
(800) 382-5544

Water and Sewer
Public Works
(219) 924-7500

DUST EXPOSURE CALCULATION WORKSHEET
ON-SITE CONTAINMENT AREA

Name of Site Safety factor for this site = 4

Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	5670	2.20E+02	1134
Antimony	0.5	5.3	2.36E+04	10.6
Arsenic	0.01	21.3	1.17E+02	2130
Barium	0.5	515	2.43E+02	1030
Beryllium	0.002	0.44	1.14E+03	220
Cadmium	0.005	6	2.08E+02	1200
Carbofuran	0.1	0.000000001	2.50E+13	0.00000001
Cs-137(pCi/l)	60	0.000000001	1.50E+16	1.66667E-11
Chlordane	1	0.000000001	2.50E+14	0.000000001
Chromium	0.5	271	1.25E+14	542
Chrome (hex)	0.05	0.000000001	5.58E+02	0.00000002
Cobalt	0.05	22.4	5.58E+02	448
Copper	1	115	2.17E+03	115
Cyanides	5	8.7	1.44E+05	1.74
DDD	0.5	0.000000001	1.25E+14	0.000000002
DDE	0.5	0.000000001	1.25E+14	0.000000002
DDT	0.5	0.091	1.37E+06	0.182
Dieldrin	0.25	0.000000001	6.25E+13	0.000000004
Endosulfan	0.1	0.012	2.08E+06	0.12
Fluorides	2.5	0.000000001	6.25E+14	4E-10
Heptachlor	0.5	0.000000001	1.25E+14	0.000000002
Lead	0.05	1440	8.68E+00	28800
Lindane	0.5	0.000000001	1.25E+14	0.000000002
Manganese	1	614	4.07E+02	614
Mercury	0.05	12.4	1.01E+03	248
Nickel	1	12.8	1.95E+04	12.8
Oil Mist	5	0.000000001	1.25E+15	2E-10
PCBs	0.5	500.9	2.50E+02	1001.8
PNAs	0.2	150	3.33E+02	750
Phorate	0.05	0.000000001	1.25E+13	0.00000002
Phthalates	5	0.000000001	1.25E+15	2E-10
Pu-239(pCi/l)	0.003	0.000000001	7.50E+11	3.33333E-07
Ra-226(pCi/l)	0.3	0.000000001	7.50E+13	3.33E-09
Ronnel	10	0.000000001	2.50E+15	1.00E-10
Selenium	0.2	0.45	1.11E+05	2.25
Silica	0.05	0.000000001	1.25E+13	0.00000002
Silver	0.01	0.000000001	2.50E+12	0.0000001
Sr-90(pCi/l)	8	0.000000001	2.00E+15	1.25E-10
Thallium	0.1	0.000000001	2.50E+13	0.00000001
Th-230(pCi/l)	0.003	0.000000001	7.50E+11	3.33E-07
Tin	2	0.000000001	5.00E+14	5E-10
Titanium	10	0.000000001	2.50E+15	1E-10
Vanadium	0.05	20.6	6.07E+02	412
Zinc	5	747	1.67E+03	149.4
			Sum	38821.89

Dust Exposure Level at PEL for Mixture = **6.44** mg/m3 action level

Visible dust typically at about 2 mg/m3

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

$$\frac{(1E+6)(\text{Exposure Limit mg/m3})}{(\text{Concentration mg/kg})(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of [(Concentration mg/kg) / (Exposure Limit)]}}$$

DUST EXPOSURE CALCULATION WORKSHEET
STILL BOTTOMS POND AREA

Name of Site Safety factor for this site = 4

Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	7890	1.58E+02	1578
Antimony	0.5	46.6	2.68E+03	93.2
Arsenic	0.01	5.7	4.39E+02	570
Barium	0.5	1560	8.01E+01	3120
Beryllium	0.002	0.89	5.62E+02	445
Cadmium	0.005	118	1.06E+01	23600
Carbofuran	0.1	0.000000001	2.50E+13	0.00000001
Cs-137(pCi/l)	60	0.000000001	1.50E+16	1.66667E-11
Chlordane	1	0.000000001	2.50E+14	0.000000001
Chromium	0.5	1410	1.25E+14	2820
Chrome (hex)	0.05	0.000000001	3.00E+02	0.00000002
Cobalt	0.05	41.7	3.00E+02	834
Copper	1	361	6.93E+02	361
Cyanides	5	70.7	1.77E+04	14.14
DDD	0.5	0.000000001	1.25E+14	0.000000002
DDE	0.5	0.000000001	1.25E+14	0.000000002
DDT	0.5	12	1.04E+04	24
Dieldrin	0.25	0.000000001	6.25E+13	0.000000004
Endosulfan	0.1	1.2	2.08E+04	12
Fluorides	2.5	0.000000001	6.25E+14	4E-10
Heptachlor	0.5	0.000000001	1.25E+14	0.000000002
Lead	0.05	6300	1.98E+00	126000
Lindane	0.5	1.1	1.14E+05	2.2
Manganese	1	1030	2.43E+02	1030
Mercury	0.05	11	1.14E+03	220
Nickel	1	19.6	1.28E+04	19.6
Oil Mist	5	0.000000001	1.25E+15	2E-10
PCBs	0.5	158	7.91E+02	316
PNAs	0.2	1112	4.50E+01	5560
Phorate	0.05	0.000000001	1.25E+13	0.00000002
Phthalates	5	0.000000001	1.25E+15	2E-10
Pu-239(pCi/l)	0.003	0.000000001	7.50E+11	3.33333E-07
Ra-226(pCi/l)	0.3	0.000000001	7.50E+13	3.33E-09
Ronnel	10	0.000000001	2.50E+15	1.00E-10
Selenium	0.2	2.83	1.77E+04	14.15
Silica	0.05	0.000000001	1.25E+13	0.00000002
Silver	0.01	0.000000001	2.50E+12	0.0000001
Sr-90(pCi/l)	8	0.000000001	2.00E+15	1.25E-10
Thallium	0.1	0.000000001	2.50E+13	0.00000001
Th-230(pCi/l)	0.003	0.000000001	7.50E+11	3.33E-07
Tin	2	0.000000001	5.00E+14	5E-10
Titanium	10	0.000000001	2.50E+15	1E-10
Vanadium	0.05	12.1	1.03E+03	242
Zinc	5	2280	5.48E+02	456
			Sum	167331.29

Dust Exposure Level at PEL for Mixture = **1.49** mg/m3 action level

Visible dust typically at about 2 mg/m3

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

$$\frac{(1E+6)(\text{Exposure Limit mg/m3})}{(\text{Concentration mg/kg})(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of [(Concentration mg/kg) / (Exposure Limit)]}}$$

KAW/kaw/jms/TAB
J:\1252\042\28\Documents\125204228a124.xls.xls\lagoon
1252042.281201

DUST EXPOSURE CALCULATION WORKSHEET
OFF-SITE CONTAINMENT AREA

Name of Site Safety factor for this site = 4

Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	18000	6.94E+01	3600
Antimony	0.5	152	8.22E+02	304
Arsenic	0.01	9.1	2.75E+02	910
Barium	0.5	6400	1.95E+01	12800
Beryllium	0.002	0.8	6.25E+02	400
Cadmium	0.005	1700	7.35E-01	340000
Carbofuran	0.1	0.000000001	2.50E+13	0.00000001
Cs-137(pCi/l)	60	0.000000001	1.50E+16	1.66667E-11
Chlordane	1	0.000000001	2.50E+14	0.000000001
Chromium	0.5	3750	1.25E+14	7500
Chrome (hex)	0.05	0.000000001	1.81E+02	0.00000002
Cobalt	0.05	69.1	1.81E+02	1382
Copper	1	5790	4.32E+01	5790
Cyanides	5	31.3	3.99E+04	6.26
DDD	0.5	0.000000001	1.25E+14	0.000000002
DDE	0.5	0.000000001	1.25E+14	0.000000002
DDT	0.5	0.000000001	1.25E+14	0.000000002
Dieldrin	0.25	0.000000001	6.25E+13	0.000000004
Endosulfan	0.1	0.000000001	2.50E+13	0.00000001
Fluorides	2.5	0.000000001	6.25E+14	4E-10
Heptachlor	0.5	0.000000001	1.25E+14	0.000000002
Lead	0.05	17200	7.27E-01	344000
Lindane	0.5	0.000000001	1.25E+14	0.000000002
Manganese	1	441	5.67E+02	441
Mercury	0.05	36	3.47E+02	720
Nickel	1	72.6	3.44E+03	72.6
Oil Mist	5	0.000000001	1.25E+15	2E-10
PCBs	0.5	0.000000001	1.25E+14	0.000000002
PNAs	0.2	5019	9.96E+00	25095
Phorate	0.05	0.000000001	1.25E+13	0.00000002
Phthalates	5	0.000000001	1.25E+15	2E-10
Pu-239(pCi/l)	0.003	0.000000001	7.50E+11	3.33333E-07
Ra-226(pCi/l)	0.3	0.000000001	7.50E+13	3.33E-09
Ronnel	10	0.000000001	2.50E+15	1.00E-10
Selenium	0.2	157	3.18E+02	785
Silica	0.05	0.000000001	1.25E+13	0.00000002
Silver	0.01	312	8.01E+00	31200
Sr-90(pCi/l)	8	0.000000001	2.00E+15	1.25E-10
Thallium	0.1	1.5	1.67E+04	15
Th-230(pCi/l)	0.003	0.000000001	7.50E+11	3.33E-07
Tin	2	0.000000001	5.00E+14	5E-10
Titanium	10	0.000000001	2.50E+15	1E-10
Vanadium	0.05	24.3	5.14E+02	486
Zinc	5	4700	2.66E+02	940
			Sum	776446.86

Dust Exposure Level at PEL for Mixture = **0.32** mg/m3 action level

Visible dust typically at about 2 mg/m3

EQUATIONS USED IN THIS CALCULATION

Dust action level = (1E+6)(Exposure Limit mg/m3)
(For one dust) ——————————————————
(Concentration mg/kg)(Safety Factor)

Dust action level = (1E+6) / (Safety Factor)
(For mixed dusts) ——————————————————
Sum of [(Concentration mg/kg) / (Exposure Limit)]

KAW/kaw/jms/TAB
J:\1252\042\28\Documents\125204228a124.xls.xls\offsite
1252042.281201

DUST EXPOSURE CALCULATION WORKSHEET
KAPICA-PAZMEY SURFACE

Name of Site Safety factor for this site = 4

Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	13200	9.47E+01	2640
Antimony	0.5	84.8	1.47E+03	169.6
Arsenic	0.01	30.6	8.17E+01	3060
Barium	0.5	5730	2.18E+01	11460
Beryllium	0.002	1.5	3.33E+02	750
Cadmium	0.005	174	7.18E+00	34800
Carbofuran	0.1	0.000000001	2.50E+13	0.00000001
Cs-137(pCi/l)	60	0.000000001	1.50E+16	1.66667E-11
Chlordane	1	0.000000001	2.50E+14	0.000000001
Chromium	0.5	3080	1.25E+14	6160
Chrome (hex)	0.05	0.000000001	8.45E+01	0.00000002
Cobalt	0.05	148	8.45E+01	2960
Copper	1	4470	5.59E+01	4470
Cyanides	5	66.2	1.89E+04	13.24
DDD	0.5	0.15	8.33E+05	0.3
DDE	0.5	0.000000001	1.25E+14	0.000000002
DDT	0.5	0.000000001	1.25E+14	0.000000002
Dieldrin	0.25	0.000000001	6.25E+13	0.000000004
Endosulfan	0.1	42	5.95E+02	420
Fluorides	2.5	0.000000001	6.25E+14	4E-10
Heptachlor	0.5	0.000000001	1.25E+14	0.000000002
Lead	0.05	16200	7.72E-01	324000
Lindane	0.5	0.000000001	1.25E+14	0.000000002
Manganese	1	1540	1.62E+02	1540
Mercury	0.05	9.5	1.32E+03	190
Nickel	1	197	1.27E+03	197
Oil Mist	5	0.000000001	1.25E+15	2E-10
PCBs	0.5	329	3.80E+02	658
PNAs	0.2	180	2.78E+02	900
Phorate	0.05	0.000000001	1.25E+13	0.00000002
Phthalates	5	729	1.71E+03	145.8
Pu-239(pCi/l)	0.003	0.000000001	7.50E+11	3.33333E-07
Ra-226(pCi/l)	0.3	0.000000001	7.50E+13	3.33E-09
Ronnel	10	0.000000001	2.50E+15	1.00E-10
Selenium	0.2	17.2	2.91E+03	86
Silica	0.05	0.000000001	1.25E+13	0.00000002
Silver	0.01	24.8	1.01E+02	2480
Sr-90(pCi/l)	8	0.000000001	2.00E+15	1.25E-10
Thallium	0.1	0.000000001	2.50E+13	0.00000001
Th-230(pCi/l)	0.003	0.000000001	7.50E+11	3.33E-07
Tin	2	0.000000001	5.00E+14	5E-10
Titanium	10	0.000000001	2.50E+15	1E-10
Vanadium	0.05	47.7	2.62E+02	954
Zinc	5	15800	7.91E+01	3160
			Sum	401213.94

Dust Exposure Level at PEL for Mixture = **0.62** mg/m3 action level

Visible dust typically at about 2 mg/m3

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

$$\frac{(1E+6)(\text{Exposure Limit mg/m3})}{(\text{Concentration mg/kg})(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of [(Concentration mg/kg) / (Exposure Limit)]}}$$

KAW/kaw/jms/TAB
J:\1252\042\28\Documents\125204228a124.xls.xls\KPSurf
1252042.281201

DUST EXPOSURE CALCULATION WORKSHEET
KAPICA-PAZMEY SUBSURFACE

Name of Site Safety factor for this site = 4

Chemical	Exposure Limit (mg/m^3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (mg/m^3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	4580	2.73E+02	916
Antimony	0.5	10.8	1.16E+04	21.6
Arsenic	0.01	2.3	1.09E+03	230
Barium	0.5	1490	8.39E+01	2980
Beryllium	0.002	0.18	2.78E+03	90
Cadmium	0.005	40.4	3.09E+01	8080
Carbofuran	0.1	0.000000001	2.50E+13	0.00000001
Cs-137(pCi/l)	60	0.000000001	1.50E+16	1.66667E-11
Chlordane	1	0.000000001	2.50E+14	0.000000001
Chromium	0.5	1010	1.25E+14	2020
Chrome (hex)	0.05	0.000000001	1.04E+03	0.00000002
Cobalt	0.05	12	1.04E+03	240
Copper	1	478	5.23E+02	478
Cyanides	5	21.3	5.87E+04	4.26
DDD	0.5	0.000000001	1.25E+14	0.000000002
DDE	0.5	0.000000001	1.25E+14	0.000000002
DDT	0.5	0.000000001	1.25E+14	0.000000002
Dieldrin	0.25	0.000000001	6.25E+13	0.000000004
Endosulfan	0.1	0.000000001	2.50E+13	0.00000001
Fluorides	2.5	0.000000001	6.25E+14	4E-10
Heptachlor	0.5	0.000000001	1.25E+14	0.000000002
Lead	0.05	4060	3.08E+00	81200
Lindane	0.5	0.000000001	1.25E+14	0.000000002
Manganese	1	105	2.38E+03	105
Mercury	0.05	2.3	5.43E+03	46
Nickel	1	12.7	1.97E+04	12.7
Oil Mist	5	0.000000001	1.25E+15	2E-10
PCBs	0.5	59.6	2.10E+03	119.2
PNAs	0.2	65	7.69E+02	325
Phorate	0.05	0.000000001	1.25E+13	0.00000002
Phthalates	5	166	7.53E+03	33.2
Pu-239(pCi/l)	0.003	0.000000001	7.50E+11	3.33333E-07
Ra-226(pCi/l)	0.3	0.000000001	7.50E+13	3.33E-09
Ronnel	10	0.000000001	2.50E+15	1.00E-10
Selenium	0.2	1.5	3.33E+04	7.5
Silica	0.05	0.000000001	1.25E+13	0.00000002
Silver	0.01	64.3	3.89E+01	6430
Sr-90(pCi/l)	8	0.000000001	2.00E+15	1.25E-10
Thallium	0.1	0.000000001	2.50E+13	0.00000001
Th-230(pCi/l)	0.003	0.000000001	7.50E+11	3.33E-07
Tin	2	0.000000001	5.00E+14	5E-10
Titanium	10	0.000000001	2.50E+15	1E-10
Vanadium	0.05	11.3	1.11E+03	226
Zinc	5	2200	5.68E+02	440
			Sum	104004.46

Dust Exposure Level at PEL for Mixture = **2.40** mg/m3 action level

Visible dust typically at about 2 mg/m^3

EQUATIONS USED IN THIS CALCULATION

Dust action level = (For one dust)

$$\frac{(1E+6)(\text{Exposure Limit } mg/m^3)}{(\text{Concentration } mg/kg)(\text{Safety Factor})}$$

Dust action level = (For mixed dusts)

$$\frac{(1E+6) / (\text{Safety Factor})}{\text{Sum of } [(\text{Concentration } mg/kg) / (\text{Exposure Limit})]}$$